

# POPULAR SCIENCE

Dollar-Saving Formula:

**How to Figure  
When to Trade In  
Your Car**

PAGE 107

AUGUST • 35¢ Monthly

New  
2-Piece TV



# "Cleaning and waxing my car took 1¼ hours

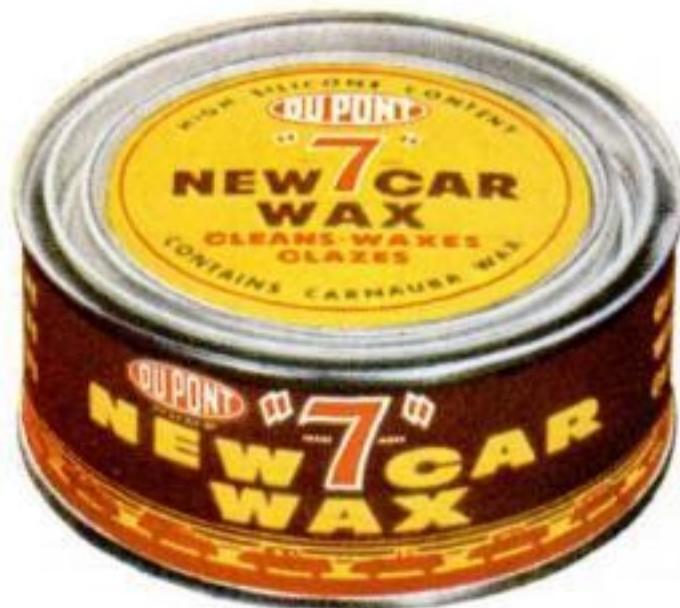


## with Du Pont's NEW CAR WAX



## ... it's still sparkling after 6 months"

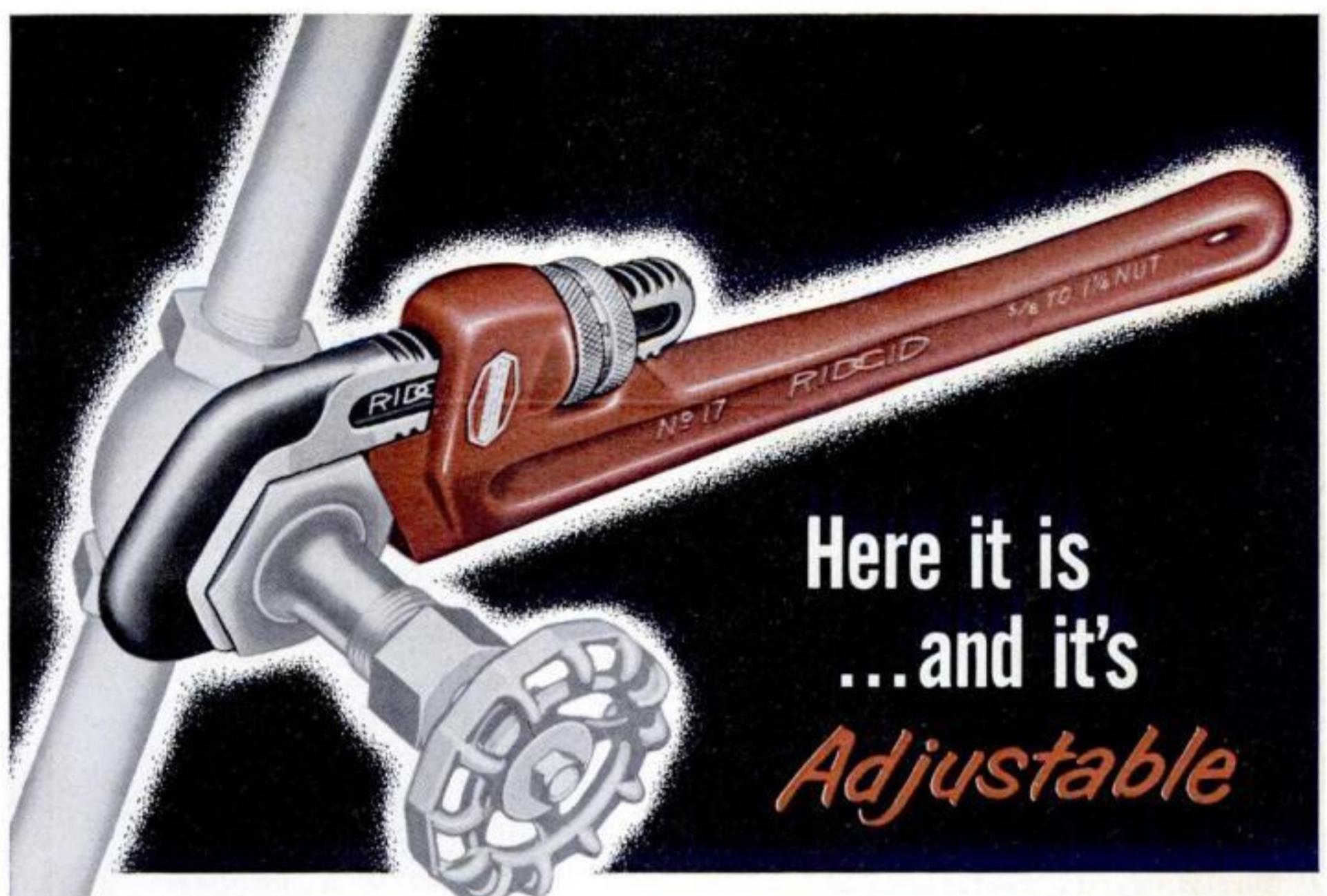
says Bill Dec of Huntington, N. Y., after waxing his '56 Ford with Du Pont New Car Wax. Bill discovered that this new paste wax is as easy to use as a liquid polish, because it cleans, waxes and glazes—all in *one easy application*. Yet it protects with real Carnauba wax, *the toughest wax known*. Proof of protection is the long-lasting gleam. Six months, 12 car washings later, the finish still shows clear reflections of Bill and his wife! Try Du Pont New Car Wax—it makes any good finish look new! At service stations and auto supply stores. Only \$2.00.



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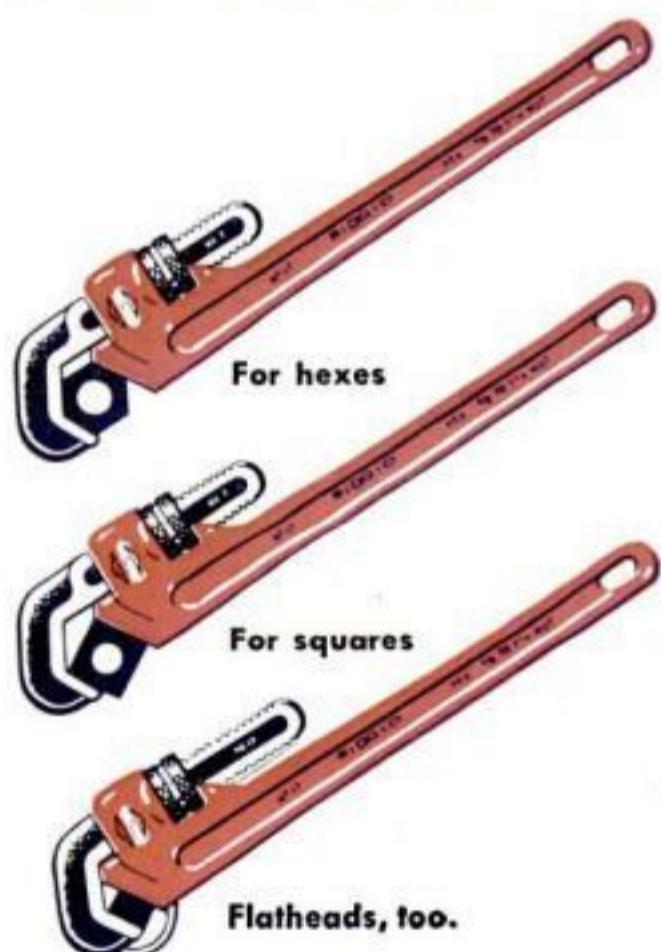
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# Popular Science Monthly

**August, 1958**

Cover photo by Robert D. Borst



Now . . . the second-by-second report on those tense moments as a big missile thunders skyward.



Perched high up, PS' Bill Morris shoots his story: Big News in fire engines.

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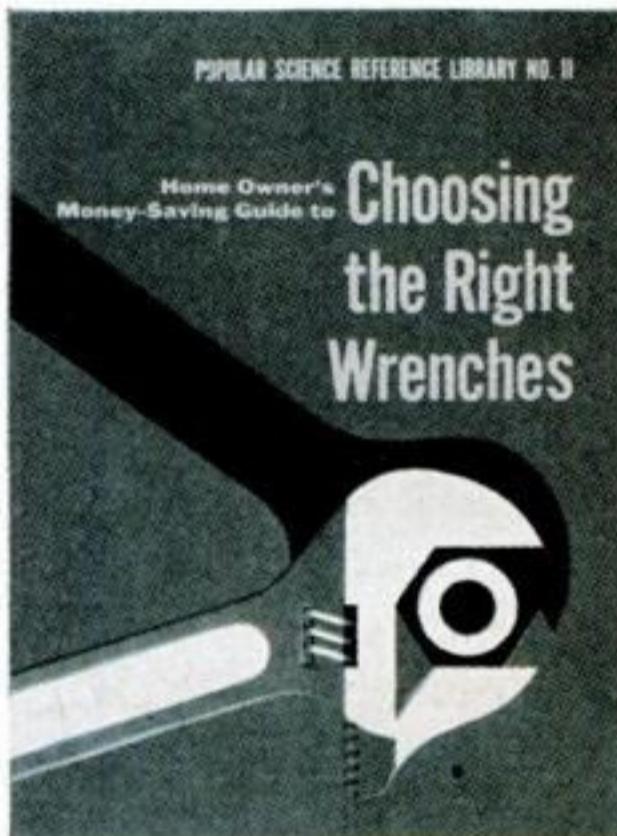
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# PS Readers

## TALK BACK

### Used-Car Checklist: Two Views

I HAVE been in the car business for 22 years and I doubt that there is a salesman who'd spend any time with a customer



who came in armed with your "Take-Along Checklist for Judging a Used Car" [PS, June]. Maybe 18 years ago it would have been okay. Today, there's not one used car in 100 that would stand so thorough a check.

In fact, nine out of 10 new cars tested with that list would turn up faults galore. I realize that you should get what you pay for—but is it possible to get what you pay for when buying any product today?

W. A. HARTMAN, Danvers, Mass.

... Just finished reading your June issue. Both your booklet on what to check when buying a used car, and the article, "I Check 40 Used Cars a Week," were most instructive even to me—a mechanic for more than 22 years. Congratulations.

ARISTIDES CANCEL, Mayaguez, P.R.

### Washboard Roads for Safety?

"The Car That Drives Itself" [May] would be of extraordinary value to motorists in this area. We are plagued by multiple rear-end smash-ups on our two great bridges. After any kind of traffic interruption, the car following often stops in time; but somewhere in the string of followers, a daydreamer plows into the car ahead. Then, like a row of ninepins, 16 or 18 cars ram each other.

Since human nature can't be changed, some mechanical device is the only solution. Is anyone doing any research on road corrugation? With regulated corrugations making driving conditions intolerable except at the prescribed limit, at least there would be no sleeping drivers or speeders. Jouncing would keep the sleeper awake, and the speeder would find his car uncontrollable.

ED WATSON, San Francisco.

### Spaceman Says "Roger"

I HAVE read many space stories and quite a few on the state of weightlessness. But your story ["I Was Weightless for 39 Seconds," Apr.] was perhaps the most comprehensive and readable.

My wife, who has been aware of our flights for more than three years, says that since reading it, she realizes for the first time what is going on. That is a real compliment.

MAJ. HERBERT STALLINGS  
Randolph AFB, Tex.

### Tip to Test Takers

THERE were many worth-while ideas in "How to Boost Your Score on Any Test" [May]. Anyone interested enough in his future to prepare for tests deserves the higher score he might receive.

A word of caution, though: Slanting the answers on some vocational tests just to please an employer may have the un-



pleasant result of making you that square peg in a round hole. And good tests of this type measure the inconsistencies that occur when this is attempted.

A. G. NELSON, Omaha.

### Ramp Stumps the Lady

THE ramp arrangement for basement stairs ["Wordless Workshop," Apr.] has me stumped. I presume that the hinged ramps would normally be kept turned up against the walls of the stairway. In that



# What's your boss saying about you?

The door is usually open. Today it's closed. They're talking about you . . . about our future. You don't have to hear to know what they're saying. Because there's nobody who knows more about you and our present job than *you*.

O.K. . . So you have "experience." Five years on the same job.

Have you *mastered* the job . . . learned everything there is to know about it?

If your answer is "yes," success is right around the corner. But if the answer is "no," then your experience doesn't amount to much. And chances are these things are true about you: you just "coast" along with things . . . you do nothing and go

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case, advise how the bulkhead doors could be closed. The upper corners of the ramps would interfere with closing the upper doors; and the lower corners would interfere with closing the lower door. No? MRS. WM. P. PASHLEY, Wellesley, Mass.

No. The upper corners are a step short of the top. And this particular basement has no lower door.

#### Foreign Cars a Blot on Patriotism?

IN YOUR June issue, a reader criticizes those who own small foreign cars and implies that they are unpatriotic and helped bring on a recession.

For several years I've owned two different small British sedans. They have carried me faithfully and, compared to a lot of U. S. cars, for every gallon of gas consumed they saved two. If the character wants to be patriotic, let him buy



a small car and conserve fuel—to say nothing of iron and steel—for future generations. There will never be any more when this is gone.

C. B. TIMMONS, Middletown, Ohio.

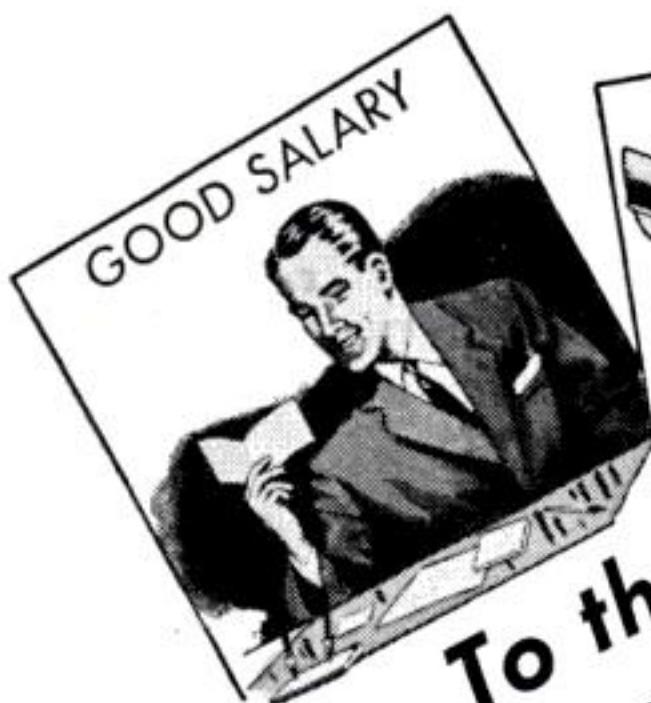
. . . That Ohio reader's remarks on foreign cars prove that he is not familiar with the facts relating to imports.

The truth of the matter is that several foreign-car manufacturers are obtaining by barter American-made subassemblies which they use for assembling equipment for some of our Allies. Thus both sides are really profiting. Every time a foreign car is sold here, our own export trade is profiting.

G. G. RUBEN, Everett, Wash.

. . . That letter asking what's wrong with American cars certainly undermines the American ideal of obtaining the most that money can buy. When an increase in price doesn't bring added value, need Mr. Horner ask such a question?

Just because Detroit has changed the status of a car from its old concept—a vehicle of transportation—to its present



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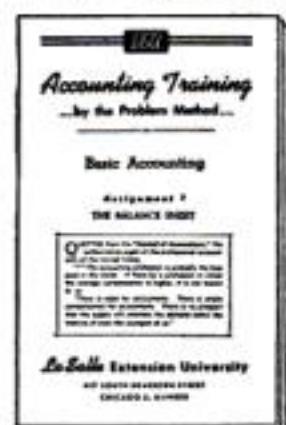
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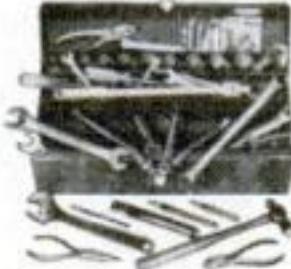
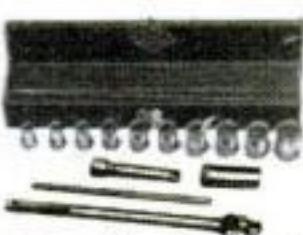


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concept—nothing more than clothing—is no reason some of us have to pay for costly style changes.

HAP KIMMA, Holmes, N.Y.

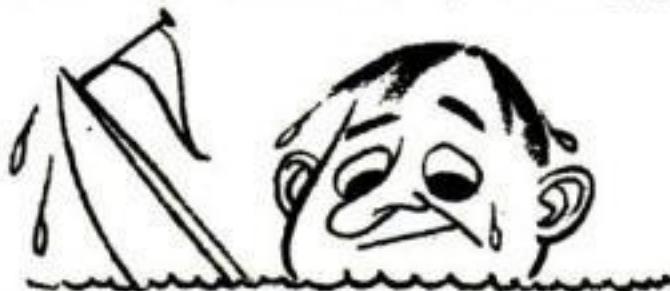
## An Inventor Comes In Late

I HAVE been looking over the May issue and noticed on the "I'd Like to See Them Make" page the plea of one of your readers for someone to invent an automatic hose reel that can be installed in the basement. What you have described, and almost illustrated, is our Water Boy reel.

F. P. ZIERDEN, Pres.  
The Zierden Co., Milwaukee.

## Both Ends AND the Middle

IF YOU want both ends of your outboard motorboat to stay up ["How to Make a Boat Unsinkable," June], you'd



better put all of that expanded-plastic foam near the motor. To reduce the danger of capsizing after flooding, put the foam all the way outboard at both sides of the hull, as high as possible, and use a generous amount.

I am a naval architect at the Boston Naval Shipyard and have conducted buoyancy and stability tests on flooded Navy small boats with foam installed.

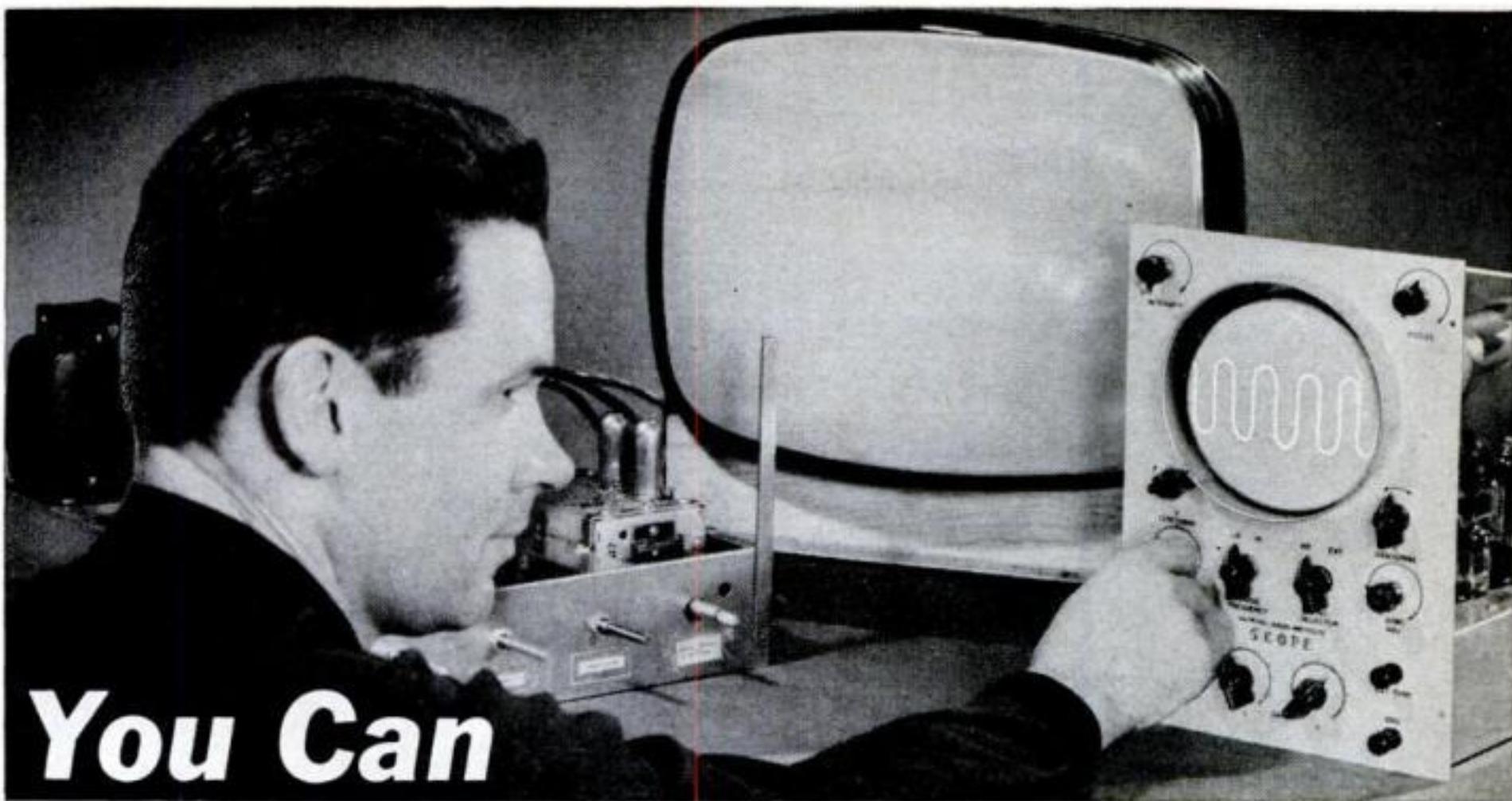
R. E. WOLFE, Brookline, Mass.

Space may limit the amount of foam that can be packed into the stern. The important thing is to pack in enough foam to keep the boat and its gear afloat, and to place it high enough to keep the boat from capsizing.

## "Amazing Tote" Amazes Maker

BECAUSE the company that makes the Totalisator is one of our subsidiaries, one of our directors sent me your May issue. I read your story ["The Amazing Tote"] with much interest and found it one of the most comprehensive stories that has ever been written on the Totalisator and the part it has played in the growth of the racing industry.

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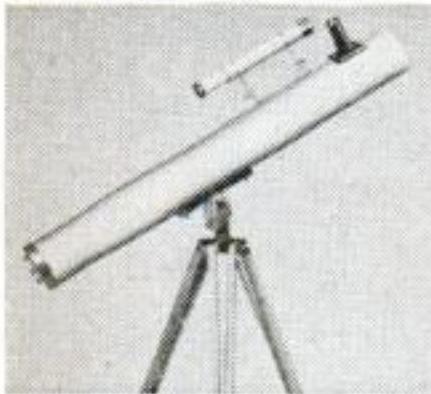
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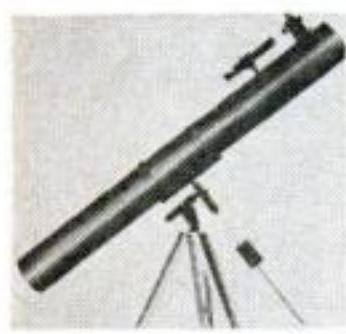
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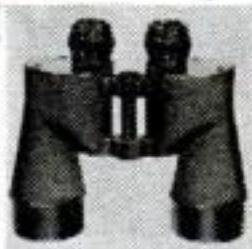
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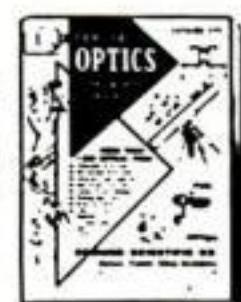
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# The month in science

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**The oldest lifesaving method is the best.** The Bible describes the quickening of Adam (Genesis 2:7): "And the Lord God . . . breathed into his nostrils the breath of life . . ." Now medical experts think that is what you, too, should do if you have to put the breath of life back into someone who has temporarily lost it: Breathe directly into the victim's mouth.

Latest research on artificial respiration was reported by four separate scientist teams in the Journal of the American Medical Association. The conclusion: Mouth-to-mouth breathing is "unequivocally superior" to manual techniques of lifesaving. The researchers cite these reasons:

- It is simple and easy to learn. Most people can do it satisfactorily after only one demonstration.
- It is not tiring. You could keep it up for an hour or more even if the victim were twice your size.
- You know immediately if the air pathway is blocked (the most common cause of failure).
- Your hands are free to keep the victim's mouth open.

The Red Cross, which handles most first-aid training, has already standardized on the mouth-to-mouth technique for use on children. The new research makes certain quick adoption of the method for adults, too.

Here is how to do it (condensed from the instructions for use on children):

1. Use your middle finger to clear the victim's mouth and hold his tongue forward.
2. Turn the victim face-down, head-down, and pat him firmly on the back.
3. Roll him on his back and use the middle fingers of both hands to lift the lower jaw from beneath and behind so that it juts out. Then hold his jaw that way with one hand.
4. Place your mouth tightly over his mouth and nose and breathe into him steadily, pressing your free hand against his abdomen under his ribs (to keep air out of his stomach).
5. When his chest rises, take your mouth away and let him exhale. Repeat this cycle—breathe in and out—20 times a minute.
6. Once a minute (every 20 cycles) rest long enough to take one deep breath on your own.

**Bingo on uranium.** For 10 years the Government has made a standing offer of a \$10,000 bonus for discovery of super-super uranium ore. Last spring the prize was finally claimed. Lisbon Uranium Co. delivered 22 tons of uraninite-pitchblende that assayed nearly 23 percent uranium oxide, slightly better than the prize requirements (20 tons, 20-percent rich). Besides the jackpot, Lisbon also collected \$51,000 for the ore itself.

The extraordinarily pure ore came from the Big Indian Wash,

## The month in science

near Moab, Utah, the field originally explored by strike-it-rich prospector Charlie Steen. Other rich finds have been reported, but until now no one else has bothered to separate out 20 high-grade tons to qualify for the bonus money.

**Cleaner gas.** A new attack on cylinder deposits that cut power and mileage has paid off. Instead of hopping up their gasoline with ever more exotic chemicals, Esso researchers tried the full-steam-ahead approach: They eliminated some deposit-forming compounds from the final product.

The deposits come from hydrogen-carbon compounds in gas and oil and metallic compounds in additives. They coat the inside of the combustion chamber and cause knocking in two ways:

- The deposits block heat removal, raising the temperature of the fuel-air mixture so that it burns unevenly (spark knock).
- The deposits catch on fire (surface ignition).

Tests made by Esso showed that additives to control combustion take care of surface ignition, but may make the spark-knock situation worse. So the Esso scientists set out to determine which hydrocarbons in the gasoline were deposit-prone—no simple task since gas is nearly all hydrocarbon (99-plus percent) and contains hundreds of different kinds.

The job was done with radioactive isotopes. Test batches of gas were made up, each with a different hydrocarbon compound labeled by the inclusion of radioactive carbon atoms in its molecules. Measuring the radioactivity of the deposits formed after each test fuel was consumed in an engine told the story:

The culprits were hydrocarbons of the type called heavy aromatics. And Esso has now altered its refining technique to keep these compounds out of its gasoline.

This doesn't mean a general return to straight no-additive gasoline (such as Amoco's). Esso still hops up its product with chemicals. And the search for new and better dopes continues.

Ethyl Corp. now has one out on test. It is AK-33X (real name: methylcyclopentadienyl manganese tricarbonyl).

This manganese additive works the same as tetraethyl lead, but better. It slows the burning of the fuel twice as effectively as lead when used alone. The improvement is still greater if both lead and manganese are added. Then the octane rating jumps about two points.

**How fast can a man run?** Not much faster than the best milers can now, apparently. Dr. Peter V. Karpovich of Springfield College (which trains phys-ed teachers) puts the limit at a mile in 3:56.6, only .6 second under Derek Ibbotson's time last summer. Nobody but a freak, Dr. Karpovich thinks, could feed his muscles enough oxygen fuel to run very much faster.

*Martin Mann*

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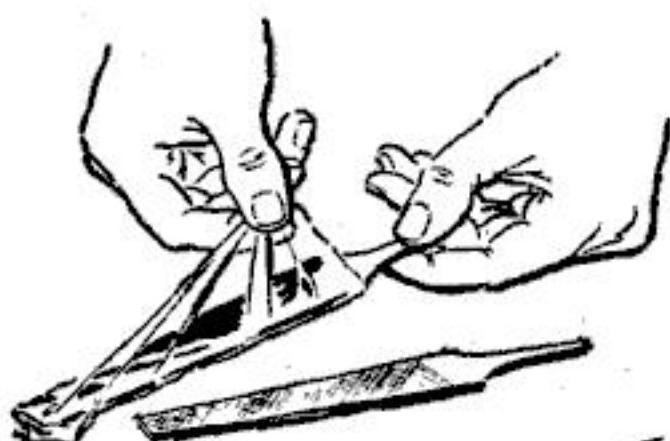
# 5 BUDGET SAVERS for Home Owners



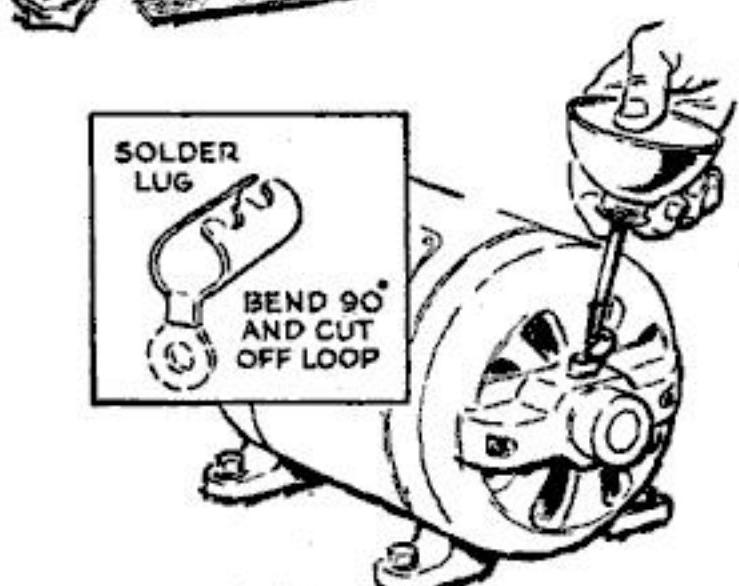
**1 A no-cost paint tray** is available in every home for the new short rollers that are sold for painting trim. Just line the dust pan with aluminum foil. The handle makes it easy to carry the pan as you paint, you can set it down without the contents running out, and you can work with much less paint than you'd need in a standard tray.



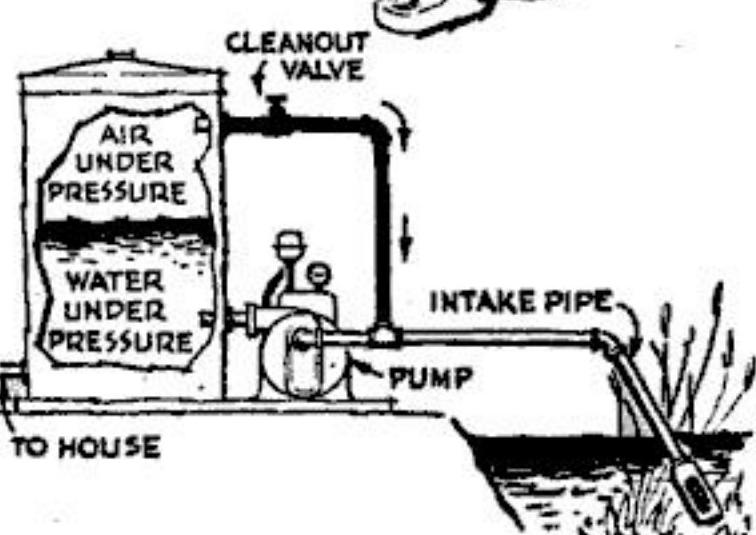
**2 Why mess up the kitchen sink** with a greasy barbecue grill? A large garbage-can lid filled with a strong grease-solvent solution keeps the worst of the job outdoors. Let the grill soak overnight, and the next day you can rinse it clean. The lid is usually still good when a garbage can rusts out, or perhaps you can find a spare in a junk shop.



**3 Good files cost money**, so don't take a chance of losing effectiveness because of rust. Wrap them in thin plastic kitchen film while they are not in use. The wrap also protects the cutting edges when the files are stored in a drawer or box with other tools.



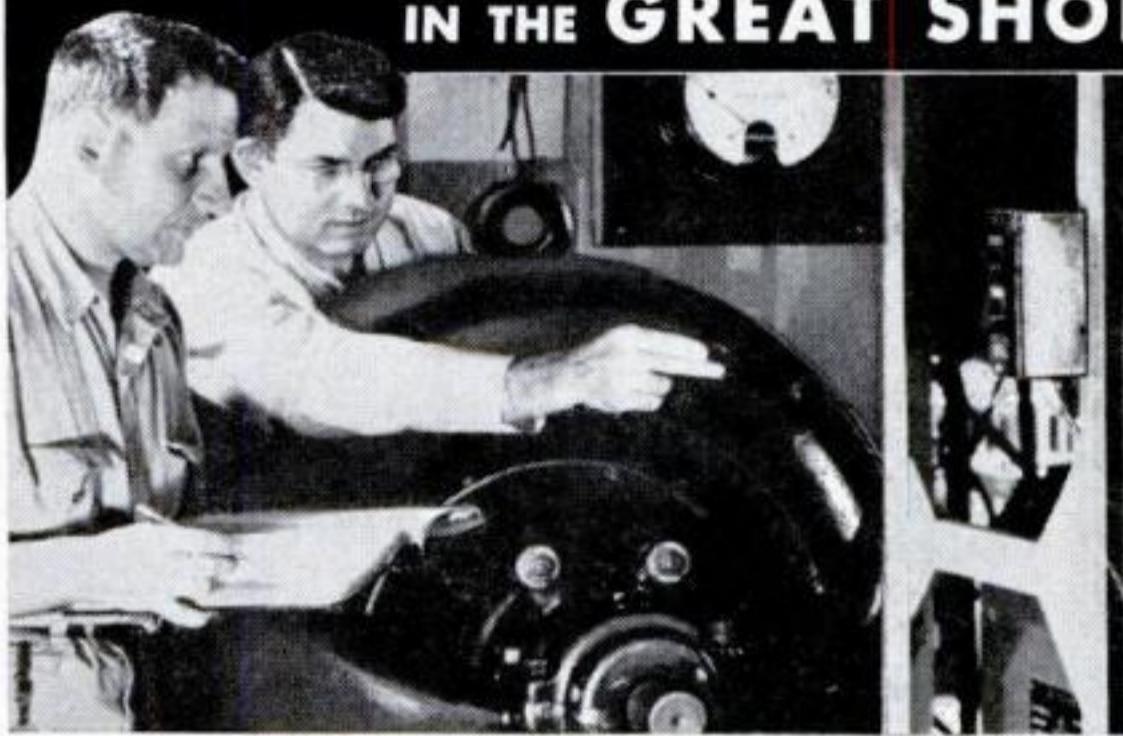
**4 Do you tend to skimp on oil**, or perhaps skip the lube job entirely, because the oil cup on a piece of household machinery is hard to reach? If so, you're inviting a breakdown and shortening the life of the appliance. An electrical-wire solder lug, adapted as shown and crimped on your oil can to tip up the oil-cup lid, makes oiling a one-hand job.



**5 A bill from the plumber** is avoided now by one reader who used to call him regularly to take apart the suction pipe at his summer place and clean out weeds drawn in through the lake intake. The addition of the cleanout valve and piping shown in the sketch solved the problem. About once a month he opens the valve and the air pressure clears all weeds out of the inlet.

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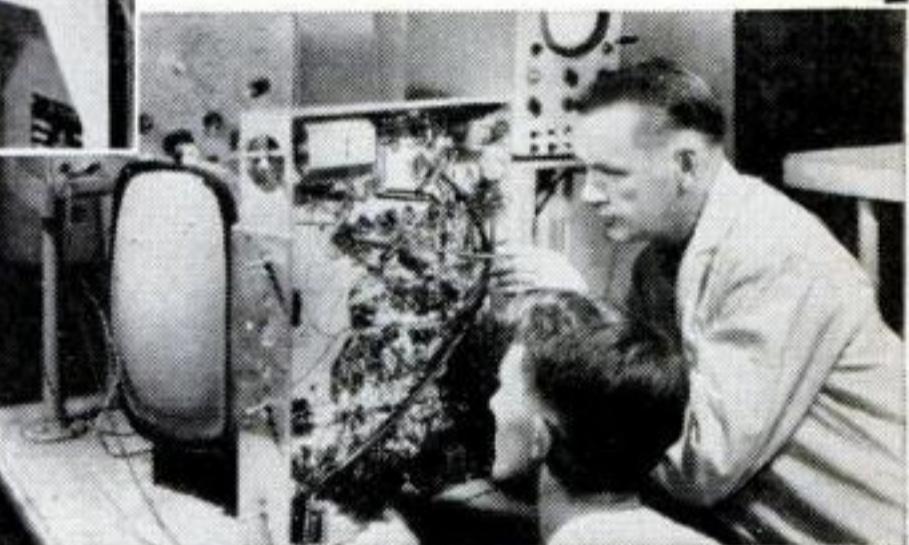
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# You ought to know...

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**Electronics in the baseball dugout.** Which is the better baseball strategist—a Casey Stengel or an electronic computer? Arthur D. Little Co., research consultants, set up an IBM computer for a game. All the (electronic) team members had equal athletic ability. Given 25 different situations in play, the computer had to come up with manager-type decisions.

The computer's advice: Shoot the works. A manager shouldn't bother with trivialities such as bunting or base-stealing. Instead, he should tell his players to hit the ball out of the park, or at least to the outfield. That way, says the computer, you're likely to win more games. But scoffing fans will inevitably claim that Stengel (or Haney) has known this all along.

**A pill for quick, deep sun tans.** It helps prevent the burn-and-blister stage, especially for sun-sensitive blonds and redheads. Research has been going on for several years [PS, July '56] but the antiburn remedy has just now got an okay—for use by adults—from the U. S. Food and Drug Administration. Upjohn is making it; trade name: Meloxine.

It does two things for your skin: (1) It ups the amount of ultra-violet you can take without burning, and (2) it speeds the tanning process. The result: You can tan deeply after a few days.

A doctor's prescription is needed. You take two pills a day, but for no longer than two weeks. The daily cost is 25 cents.

**Newer new cars for '60?** "The 1960-61 models will have more changes than any within memory. Besides extensive sheet-metal changes, there'll be dramatic engineering innovations. In scope, they'll shame the advancements of 1955," the industry's changingest year. This sweeping prediction comes from a source close to Detroit top brass.

This time it isn't the same old crystal ball, pepped up with new batteries. Evidence is strong that car makers are planning really big things for future bodies and engines, though only a few for '59. While getting the big bombs ready for '60 and '61, the manufacturers have flatly told employees to keep their mouths shut. But this much has leaked through plant fences:

- Unitized bodies. They were long a rather lonely exclusive with Rambler. Now five, possibly more, name plates are switching from the old body-and-chassis construction to unitized assemblies.
- Transaxles. This is a transmission-differential combination mounted on the rear axle. It's the solution to "that hump in the floor." Two of the Big Three lines have transaxles slated for 1961. For a complete story on them, see July PS.
- Gas-turbine engines. Mum's the word on this around Motor City, a sure sign the car makers are hard at work on turbines. One manufacturer has privately admitted big strides in boosting turbine performance and cutting production costs to make it commercially practical. Target date could be as early as 1960. Pos-

# You ought to know...

sibly one or two other manufacturers are sweating out similar deadlines for turbines.

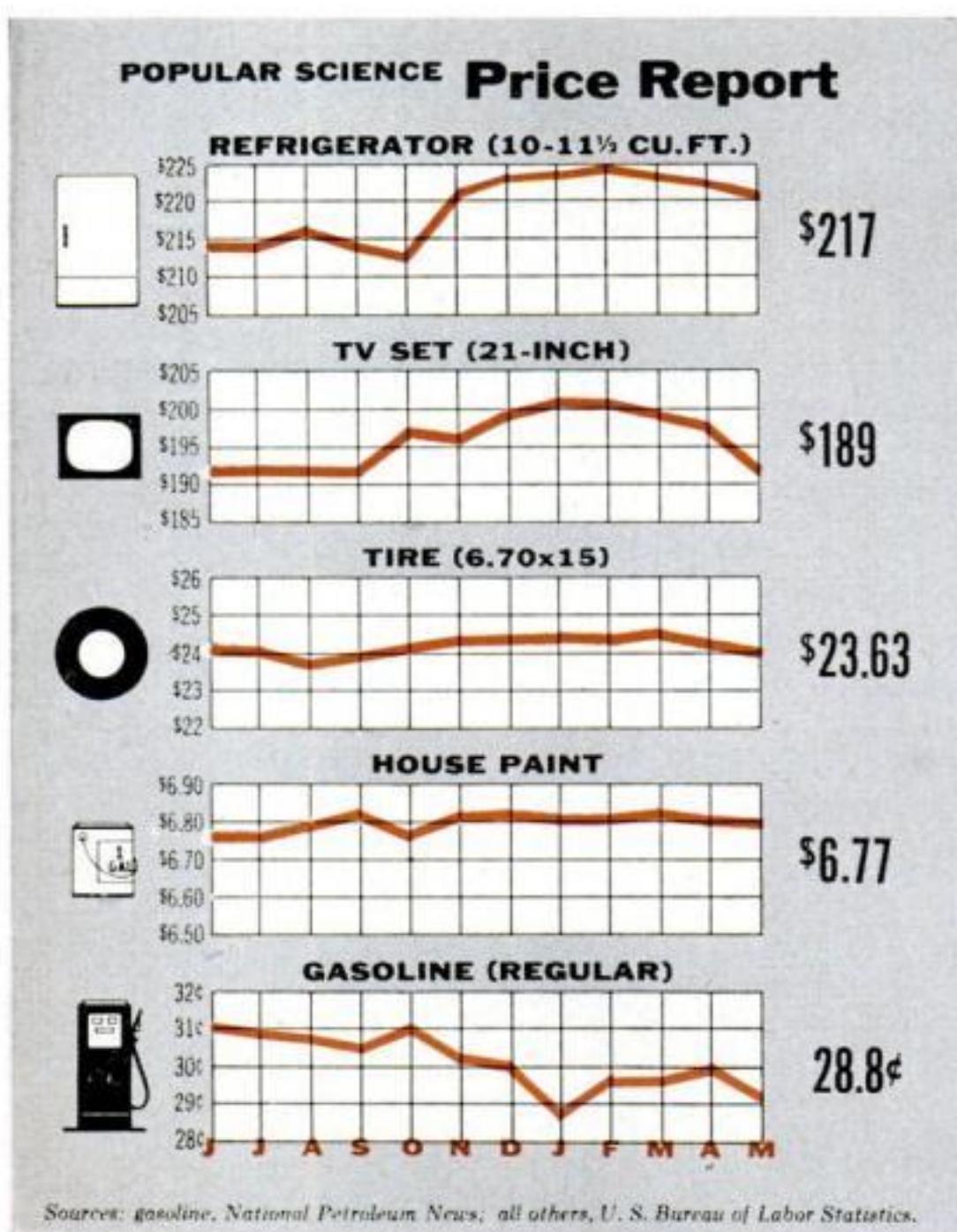
- Aluminum engines. At least one manufacturer will use aluminum engine blocks. This will cut weight, make for cheaper operation.
- Small cars. Strong contenders in the 1960-61 model race, they'll need smaller engines and bodies, whole new assembly lines. GM engineers are up to their slide rules in a crash program for a smaller automatic transmission.

Contrary to a rash of rumors about the '59 crop of cars, you can look for some real dazzlers. Everything in the GM lines will be new—in some instances, even shocking. Ford Motor and the Chrysler Corp. have made some pretty extravagant changes. In general, roof lines will be shorter while windshields and back windows will be considerably increased in depth.

**What do women drivers think of today's cars?** The National Automobile Dealers Association polled members of women's clubs to find out. Service from dealers, most said, leaves them reasonably satisfied. But, asked about car likes and dislikes, the ladies turned the air a perfumed blue. They complained that cars:

- Have too much horsepower.
- Cost too much to buy.
- Aren't designed for easy repairs.
- Need more safety features as standard equipment.
- Are designed too low, too long.
- Lack quality in materials and workmanship.
- Burn too much gas.
- Are difficult to enter and leave.
- Need more thorough inspection before leaving the factory.

The ladies' complaints jibe closely with those of polled college students. Squawks were almost the same, but order of frequency varied.



Charles M. Garvey

R. C. Anderson has launched nearly 50,000 men on successful careers. In this article he tells you about an amazing new idea which is helping many ambitious men get high-pay jobs.

# Is This the Answer to Your Prayer for Success and Security?

By R. C. ANDERSON, President

GOOD TIMES can turn sour mighty fast. One day you've got what looks like a nice job, with plenty of overtime. Next day the foreman tells you about the big layoff until further notice. Or, worse yet, you have an unskilled job that doesn't pay much. If the company starts cutting back—boom!—you're the first to get the ax. It used to be that when unemployment went up, prices went down. But no more! Prosperity or recession, the cost of living just keeps on climbing and climbing. It's real tough trying to stretch your savings to get past the rainy day.

You're fed up with a shaky job that leads nowhere. You'd like steady work with a promise of security. Better yet—a good job with an opportunity to become a highly-paid success! Picture the advantages of a top income: A modern home; a late-model car; an education for the kids; care-free vacations in America's wonderlands—and a bank account that keeps growing! You wonder, "Are such things for me? Why, I don't even have an elementary school education—how can I make the grade at my age?" I can assure you that thousands of men just like you have done it. Thousands more will. The question is: Are you willing to make an honest effort to prepare yourself for success and security?

## Let's Choose Your Field

I assume you have the determination to give yourself another chance to make good. The next step is to choose your field—to select the type of job that pays more money, offers steadier work, gives you real opportunities to start a business of your own. *My considered suggestion is that you get into the repairing industry* (which includes installation and maintenance.)

Your best bet, by far, is to become a mechanic in the uncrowded Air Conditioning and Refrigeration field. Here's why: It's one of America's great industries, yet growing like an infant. Over 150,000,000 units are in use today—and the manufacturers produce nearly 6,000,000 additional air conditioners, refrigerators, freezers, milk coolers, and industrial units annually.

## How You Get Ready

Yes, the Air Conditioning and Refrigeration industry is expanding so fast that 20,000 newly-trained mechanics are needed each year! They are needed to install and repair units in homes, stores, offices, restaurants, factories, motels and transport systems. The pay? It's terrific! Earnings of around \$150 a week are not at all unusual.

You can learn this respected, profitable craft at home in spare time. I send you 25 big kits of parts and tools—at no

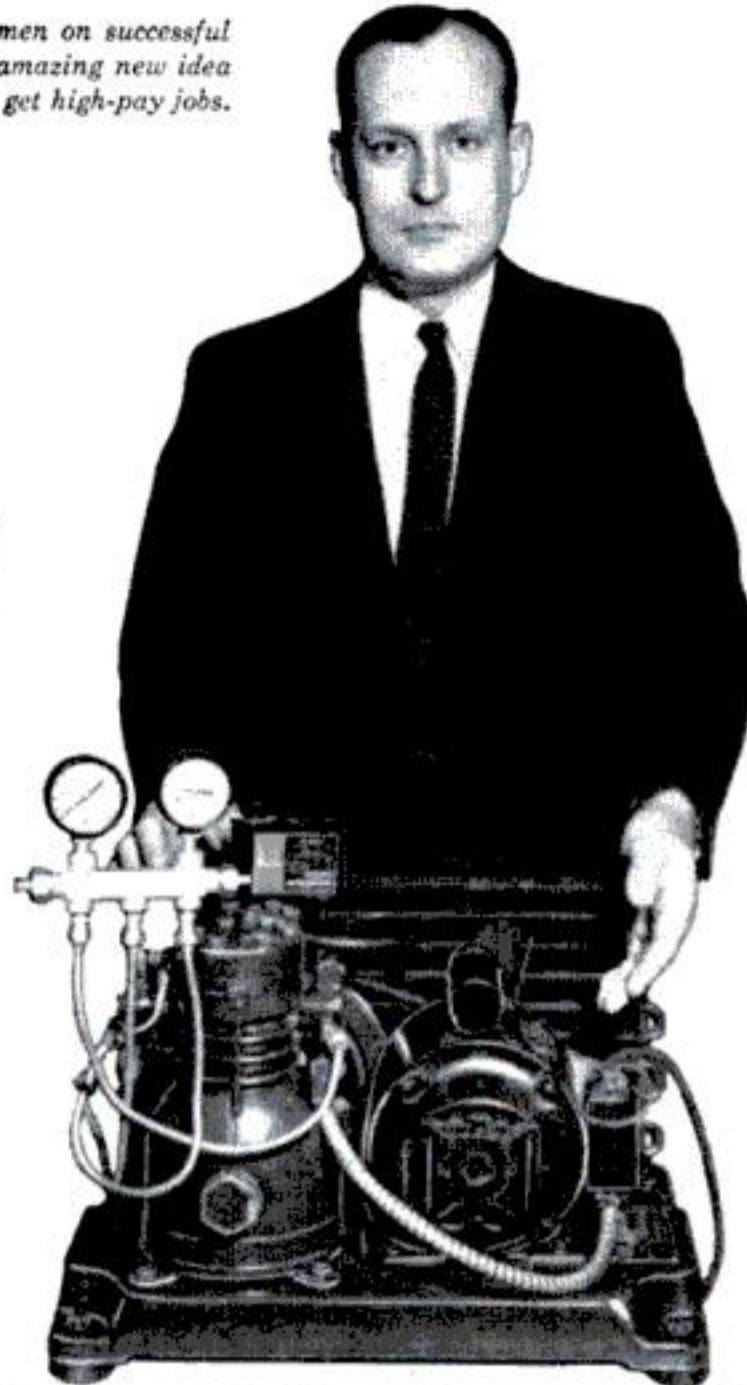
extra cost. You train by practicing—you get experience. You build a heavy-duty, commercial-type,  $\frac{1}{4}$  h. p. condensing unit (like the one I'm demonstrating in photo.) You complete 23 projects, do 10 service and trouble-shooting "jobs." And after you assemble the condensing unit, you go on to build an air conditioner, freezer, refrigerator or milk cooler! You keep all tools and parts.

## Start Cashing In Soon

I show you how to make money as you train, supplement your regular pay. My training is practical, much like field calls. Most of my students do part-time work soon after enrolling. Some get jobs with dealers, others make calls on their own. A number sign service contracts with food stores, meat markets, restaurants, etc. With their earnings, students pay tuition, buy additional shop equipment, often have enough left to open a savings account.

## Go In Business

Doing repair work for profit as you train gives you an ideal foundation for going in business for yourself. Should you work evenings or week-ends with a dealer, or even as free-lance, you are bound to make friends. You can build up a customer list of future prospects. Also, if you sign service contracts with commercial places such as restaurants and food stores, you can work on a monthly fee basis. As you can see, it doesn't take many accounts to start making big money.



Another great, new opportunity field is auto air conditioning. Almost 500,000 such units will be installed in autos this year! You could open a shop and do this type of installation for auto dealers and private car owners in your community. It's being done right now. Shops needed everywhere!

## Get Facts Now, Decide Later

Although Refrigeration Mechanics is one of the major skilled crafts, it is among the easiest to master. Operating principles are simple, free of difficult theory, and understandable by persons with limited educations. Too, there are fewer parts to work with. It's just your ticket if you are in a hurry—if you need a new and better job (that pays more money) in the shortest possible time.

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# "I'd like to see them make..."



**A DOUBLE-PURPOSE TAILGATE** on station wagons. When lowered, it could be extended and supported to serve as a table on picnics or camping trips.—*Robert J. Rish, Takoma Park, Md.*



**A MAGNETIC STRIP ON VACUUM CLEANERS** that would pick up bobby pins and needles that might damage the mechanism when sucked up.—*Mrs. C. B. Earp, Winston-Salem, N. C.*



C BERGER

**AN ESCAPE-PROOF DIP NET.** Pulling a lever would draw the net's outer, extremely flexible ring into the slotted handle to close the net on the fish.—*Joe Burke, Bay Port, Mich.*



**A CAR-RADIO VOLUME CONTROL** governed by the speedometer. You'd get volume on highways where road and wind noise are great, but no blaring in town.—*B. L. Broadwell, Towson, Md.*



**ROOFING STRIPS** of double-faced, pressure-sensitive adhesive that could be placed under gale-loosened shingles to seal and anchor them securely.—*John Sellmann, Bloomsburg, Pa.*

Everyone has his own pet idea of a gadget that he would like to see in general use. The five ideas illustrated above were suggested by POPULAR SCIENCE readers. What's

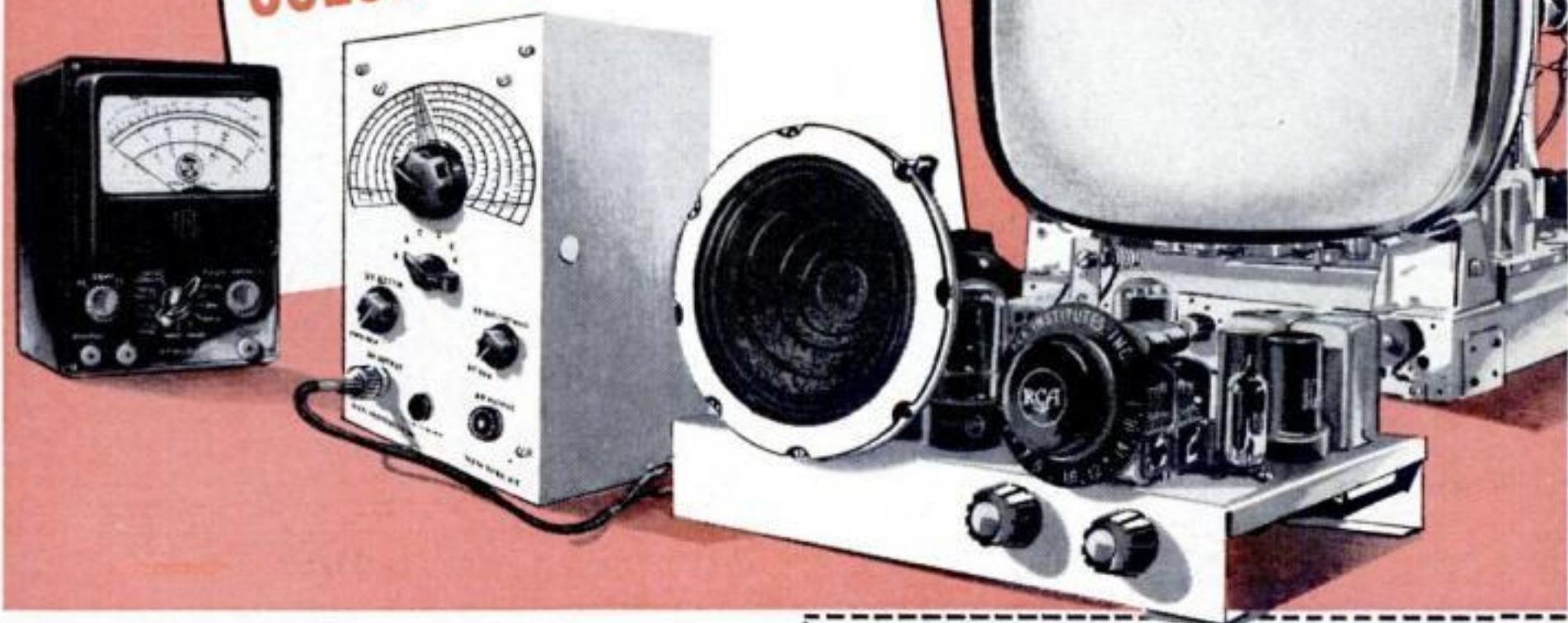
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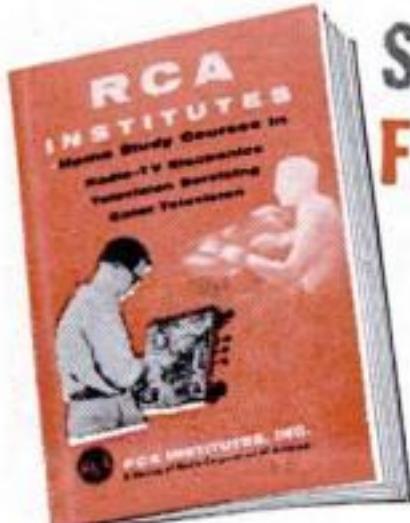
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## Brain Busters



### The Case of the Panicky Bumblebee

TWO trains, A and B, start simultaneously toward each other from stations 100 miles apart, both traveling at 50 miles per hour. A bumblebee starts the same instant from train A's cowcatcher and flies along the track at 70 miles per hour toward train B.

On encountering train B's engine, it becomes frightened and turns back, flying along the track to train A. But meeting up with it, it is again frightened and turns back toward B.

So it flies back and forth between the two trains in panicky fashion until the engines rush by each other. Engulfed in the swirl of air between them, and by now exhausted, the bee falls dead. What is the total distance it flew?

ANSWER: A mathematician would think of this problem in terms of an infinite series, the sum of which represents the total distance flown by the bee. The algebraic processes involved are complicated. But you can find the answer by simple logic. The bee flew until the trains met, and since they were both doing 50 m.p.h. on a 100-mile stretch, they must have passed midway exactly one hour after starting. The bee, which flew one mile every second, must have been flying 60 miles per hour. So it must have flown a distance of 70 miles.

Adapted from *Puzzle-Math* (Viking Press). Copyright, 1958, by George Gamow and Marvin Stern

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Learn how to protect your invention. The U. S. Patent Laws provide that any new and useful art, machine, article of manufacture, or composition of matter, or any new and useful improvement thereof, may be patented if the act of invention is involved. Therefore, every inventor with a valuable invention should take advantage of the Patent Laws and proceed for patent protection in order to safeguard his rights.

A patent gives the inventor the exclusive right to prevent others from making, using, or selling the invention claimed in the patent for a period of seventeen years.

The Patent Laws were enacted for the benefit of the inventor to give him protection for the features of his invention which are patentable. These features must be properly and concisely set forth and claimed in a formal application for patent, in order to comply with the requirements of the Patent Laws. For that reason, unless the inventor is familiar with patent matters, he should engage a competent registered patent attorney or agent to represent him. We are registered to practice before the U. S. Patent Office and are prepared to serve you in the handling of your patent matters.

A specially prepared booklet entitled "Patent Guide for the Inventor", containing detailed information with respect to patent protection and procedure, together with a "Record of Invention" form will be promptly forwarded to you without obligation upon request.

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The firm of McMorrow, Berman & Davidson, with offices in Washington, D. C., is qualified to take the necessary steps for you. We can make a preliminary search on your invention, advise you whether we think it can be patented, and prepare your application for patent.

Unless you are fully familiar with the U. S. Patent Laws, we recommend that you engage the services of a Registered Patent Attorney to protect your interests. The patent laws are *your* laws. A patent gives you the right to prevent others from making, using or selling the invention claimed in your patent for a period of 17 years.

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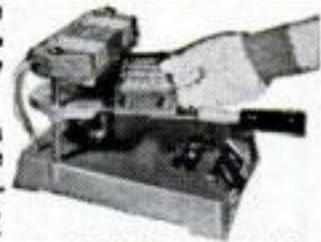
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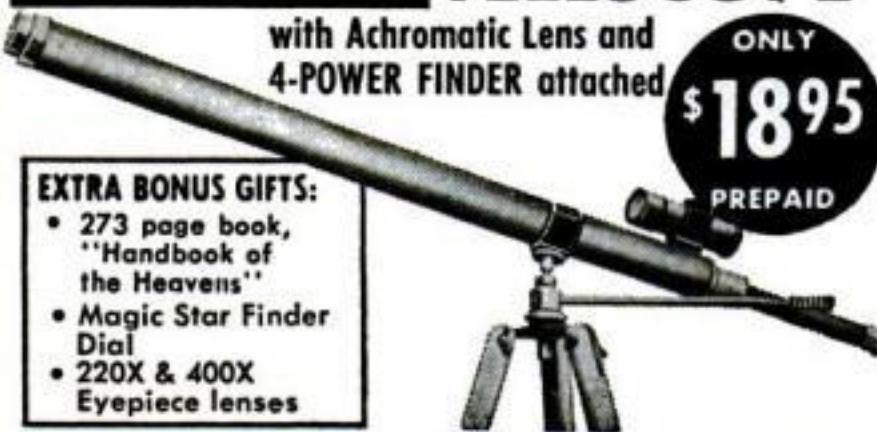
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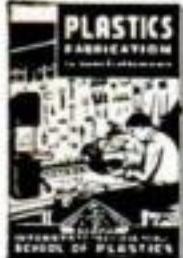
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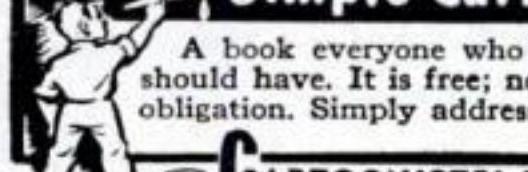
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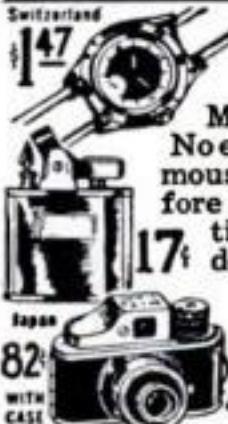
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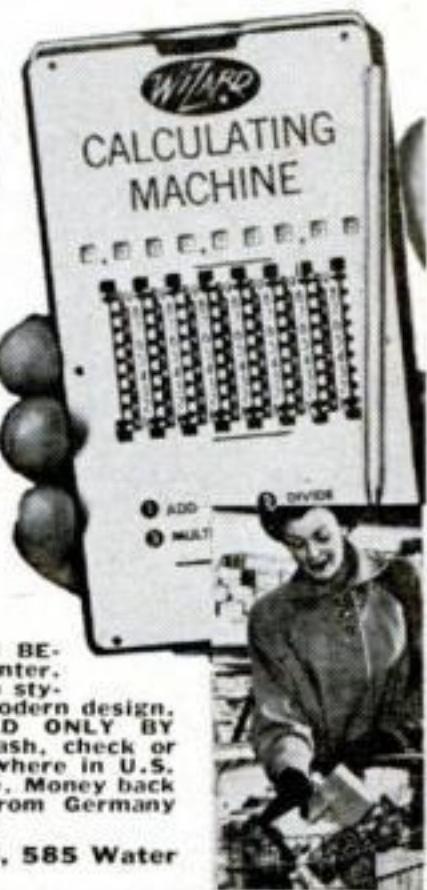
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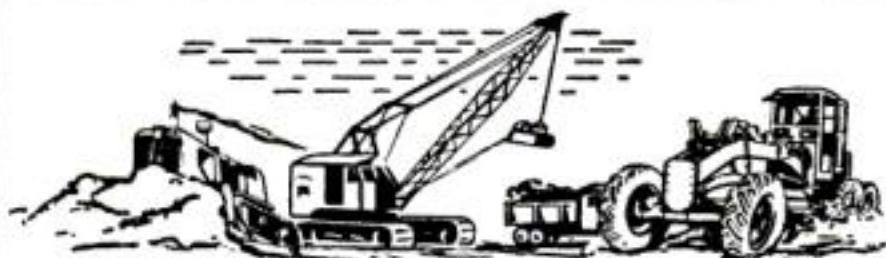
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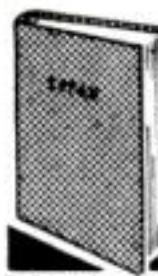
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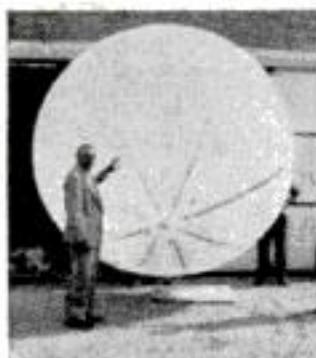
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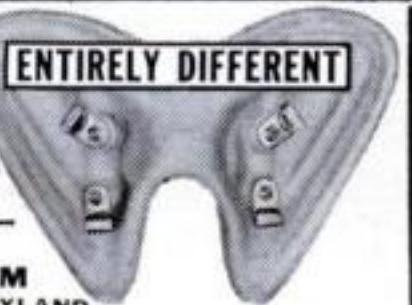
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WE Pay \$3.50 lb. dried. Grow Mushrooms. Cellar, shed and outdoors. Spare full time, year round. We have 25,000 customers. Free Book. Washington Mushroom Ind., Dept. 178, 2954 Admiral Way, Seattle, Wash.

MARKETS Everywhere. Make Artistic concrete birdbaths, pottery. Chemical coloring. Home workshop. Hundred varieties. Hollywood Cementcraft, 8527-F Wonderland, Hollywood 46, California.

WHOLESALE—Get the big merchandise-furniture, appliances, TV's, clothing, tools, auto accessories—most anything. Save half. Literature Free. Associated Wholesalers Service, 1016-C Starr, Burlington, Iowa.

NEW Importers Guide Ready to Operate Mail Order Drop Shipments Worlds Wide \$2.00. Lindsay May Co., Box 381, Delhi, Calif.

TREMENDOUS possibilities in mail order. I retired after five years. Write N. Cole, 217 West 49th, Bradenton, Florida.

BUY Direct From Factories—Appliances, Cameras, Watches! Free details! Cam Company, 6810PS-20th Ave., Brooklyn 4, New York.

FREE "Franchise Profit Letter" describes nationwide opportunities. Exclusive distributorships, dealerships, agency operations. Write today. National Franchise Reports, 333 North Michigan, Chicago 1.

\$34.70 TWO Hours. Manufacturing. No Selling. Carlyn Castings, 1803 Fremont, Rapid City, So. Dakota.

THE Law says, "You must keep records." Use our "Simplified Mailorder Book-keeping System." Recommended for small businesses, agents, salesmen, self-employed persons, mailorder "beginners," etc. \$1.00. Tasker's, Box 3131, Alexandria, Virginia.

CASH from Sawdust, Tin-Cans, Newspapers. Over 200 methods. Instructions \$1.00. Charles Company, 12-XBM, Norwood, Ohio.

INTERNATIONAL home Import Mail-order Business! Experience unnecessary. Earnings unlimited. Foreign Traders, Meramec Building, St. Louis 5-S, Missouri.

BRONZE Baby Shoes: Instructions, Equipment and Mountings for genuine Electroplating Process. Largest Supplier of all Plating Equipment, Supplies. Free Catalog. Hollywood Bronze Supply, Dept. B-1, 1624 East First, Los Angeles 33, California.

YOUR own \$10,000 a year business! No investment. Sell new Air Cushion Shoes spare time. Immediate commissions, bonus. Samples supplied. Charles Chester Shoes, 801, Brockton, Mass.

HOUSEWIVES, others. \$30.-\$100 weekly sparetime assembling rockhound jewelry. Vikingcraft, F, Inglewood 4, California.

NEW Industry Creates fabulous big money-making opportunity at home! Over 1,000,000 small damages in rugs and carpets need repairs. Homes, offices, insurance companies waiting for local service. We teach you how to invisibly repair them. Up to \$25.00 profit for one hour's work. Quick, easy to do. No selling. Details Free. Carpeton, 1256 W. 59th St., Chicago 35, Ill.

\$7500. YEARLY: invest only 20 hours weekly. Respectable. Permanent home business. Instructions \$1.00; details 3c stamp. Young, 1320 Lynnwood, Johnson City, Tenn.

SENSATIONAL profit opportunity. Amazing new device enables any handyman do professional TV repairs without experience or training. Do most \$5, \$10, \$20 service jobs in half hour. Up to \$200 month easily possible— evenings, weekends. Big demand. Start immediately. Free! Write Electronic Engineering, Dept. BC-188, 1038 S. LaBrea, Los Angeles 19.

SENSATIONAL! "Modern Mailorder promotional Opportunities." Exciting facts Free! Associate, 2694 So. 10th, Fresno 25, California.

EARN money. Sharpen cutters, scissors, saws. Precision machinery. Treyco Products, North Tonawanda 1, New York.

MONEY Available For Investment In Worthwhile Mail Order Enterprise. We Finance Your Idea If Qualified. SMM, Box 432-A, Detroit 31, Michigan.

COINLESS food vending machine. Pat. 2,611,673; option, sale, royalty. Riise, Box 855, Modesto, Calif.

OPPORTUNITY Earnings to thousands yearly part. Full Time proven business Franchise details. Tobacco line. Henford, Dept. P.S. P. O. Box 59, Paramus, N.J.

MAKE \$200.00 Monthly Spare Time with Jigsaw. Free Details. Elkman, 346 N. Summit, Sioux Falls, S. Dak.

AMAZING Profits! World-wide Home Business—Free Details: Importers, 9393 Vanderhoeven, San Antonio 9, Texas.

CANDIED Popcorn and Potato Chip Equipment. Eakins, Box 933-B8, Springfield, Ohio.

COLORGLAZED Concrete pottery made without molds. Patented method. Cemetery products, novelties, tiles. Basement leak-sealing. Money-making projects. Booklet, details free. Men only. National Potteries, Grand Rapids, "Minnesota."

\$250 WEEK reported! Free book "505 Odd, Successful Businesses." Work home! Expect something Odd! Pacific-36C, Oceanside, California.

BUY Wholesale. 30-50% discounts. Nationally famous brands. Typewriters, housewares, appliances, watches, furniture, musical instruments, cameras, tools, etc. Consolidated Distributors, Clifton 5, New Jersey.

INCOME from local information. No Selling. Write Neherco, LaVerne, Calif.

START a business in spare time. Free plan. Beran Mfg. Co., 906 East Dullnig, San Antonio 10, Texas.

IMPORTS Secret tips Sources, Mail order, Hows. Free Information. Radfords, 736 E. 49th Ave., Gary, Ind.

\$3.00 HOUR. Home Assembly. Information 25c. Renco Company, 511 E. G., Tower City, Pa.

MAKE \$46 From Square Foot Plywood; Jigsaw necessary. Free Details. Woodarts, Bridgewater, Mass.

PIANO Tuning learned quickly at home. Tremendous field! Musical knowledge unnecessary. Information free. Empire School of Piano Tuning, Champaign, Illinois. (Founded 1935.)

QUICK-brick. Home improvement bonanza. Speedy production, our methods. High profits. Work from Home. Free book. Art-Stone, Box 856-C, St. Louis, Mo.

FREE Folio "\$5,000-\$45,000: Unlimited Vacations." No merchandise. Unknown! Work home! Haylings-S-16, Carlsbad, Calif.

MAKE Money In Mail Order. Magazine, New Products Report sent for 35c. Davies Co., Box 54, Hammond, Ind.

LEARN Piano Tuning at home! Big profits. Uncrowded Field. Write Musical Enterprises, Box 5074-S, St. Paul, Minnesota.

"EVERYBODY Likes Candy"—Make Professionally Home. (Our 48th Year.) Ragsdale Candies, D107, East Orange, New Jersey.

MAKE Big Profits clipping newspaper items for publishers. Instructions explain how. Particulars free. National, 81-N, Knickerbocker Station, New York.

\$30-\$60 WEEKLY addressing envelopes. Instructions \$1, refundable. Reiss, 210 Fifth Ave., Suite 1102-W, New York 10.

\$6,000 FOR Mister, Mrs.: \$3,500! Free "Secret Journal" Plan. Magical! Work home! Publico-N33, Oceanside, Calif.

LIQUID Rubber. Make flexible molds. Free Sample. Chaney, 1907-C East Rd., Jacksonville 11, Fla.

MANY earn \$14,500.00 annually with Lemar Franchises, Box 2002, Hollywood 28, California.

BUY Wholesale. 100,000 nationally advertised products. Appliances, cameras, sporting goods, housewares, watches, typewriters, tools, clothing, etc. Discounts to 80%. Buy-Rite, Box 258, Hawthorne 5, New Jersey.

## 38 MONEYMAKING OPPORTUNITIES

HOTTEST Mail Order Plan Ever! Sell photos, films, art novelties. Huge proven profits! Free Details! Profits Unlimited. Dept. 2L, 15015 Ventura Blvd., Sherman Oaks, Calif.

START Big-Pay business at home in spare time. No experience needed to operate little table-top machine for bronzing baby shoes. Make \$5.46 profit on every pair. Full particulars free. Send postcard to Mason, 1512 Jarvis, Room CM-3-H, Chicago 26, Illinois.

BIG Money Raising Giant Tropical Worms. Spare room, basement, garage. Amazing odorless, soilless method. Charlie Morgan, 116B, Bushnell, Florida.

DETECTIVES—Work home—Travel. Experience unnecessary. Detective Particulars free. Write Wagoner, P-125 West 86th, New York 24.

SELL Titania Gems: far more brilliant than diamonds. Catalog 10c. Diamonite, 2420-S 77th, Oakland 5, California.

MAKE \$5,000 yearly sparetaking mink, chinchillas, nutria, etc. Free booklet reveals proved plans. Write: Furs, 588 Mt. Pleasant Road, Toronto 2, Canada.

MAKE Money Writing Short Paragraphs! No tedious study. I tell you what to write, where and how to sell; and supply list of editors buying from beginners. Many small checks add up quickly. Write to sell right away. Send for free facts. Benson Barrett, Dept. C86-U, 7464 Clark, Chicago 26.

VENDING Machines—No Selling. Operate A Route of Coin Machines And Earn Amazing Profits. 32-Page Catalog Free. Parkway Machine Corporation, Dept. 19, 715 Ensor Street, Baltimore 2, Maryland.

WE Pay \$3.50 lb. dried. Grow Mushrooms. Cellar, shed and outdoors. Spare full time, year round. We have 25,000 customers. Free Book. Washington Mushroom Ind., Dept. 179, 2954 Admiral Way, Seattle, Wash.

EASY to start rubber stamp business at home in spare time. Make up to \$9.80 an hour without experience. Facts free. Write to Roberts, 1512 Jarvis, Room CR-3-H, Chicago 26.

FREE Literature—Make Big Money Raising Fishworms and Crickets. Carter Farm-11, Plains, Ga.

HUGE Profits! Opportunity manufacturing concrete utility item. Send \$2.00 for plans, instructions. Cretepost, Box 38, Windsor, New York.

AMAZING successes through franchises! Become exclusive franchise holder your territory. Information rushed. National Franchise Reports, 333 North Michigan, Chicago 1.

PAY Off! Dollars Every day. Guaranteed. Setup free. Miller, Box 588-X, Oshkosh, Wisc.

MAKE Money, Operating Mail Order Business, Selling Business Cards. Vosacek Printing, 4444PS Ute, San Diego 17, Calif.

EARN spare time cash preparing-mailing advertising. Temple Co., Muncie 7, Indiana.

PROFIT-Makers all lines. Huge Discounts Home Opportunities. New. Free illustrated details. Trello, 14042 Erwin, Philadelphia 16F.

SELENIUM Rare As Uranium Details 25c. Allied Associates, Dexter, Maine.

DOLLARS every day in your mail. Easy step by step plan brings results. Send only \$1. for kit of easy home plan plus sample of work. Rich uncrowded field. Home Supply Company, Box 82, Arlington, Texas.

MAKE and sell artificial flowers. Easy kit, catalog, \$1.00. Hauser House, Box 6524-S, Phoenix, Arizona.

FREE Folio "\$5,000-\$45,000: Unlimited Vacations." No merchandise. Unknown! Work home! Haylings-S-16, Carlsbad, Calif.

MEN! Make Extra Money Selling Fast-Selling Line: reasonably priced toys, gift wraps, greeting cards, collector's items, household gadgets. Work your own hours. Extra income without changing jobs. Take orders from colorfully illustrated free catalog of over 700 money-makers. No big investment. No experience needed. Samples on approval. Write: North Star, 8-592 Finch Bldg., St. Paul 1, Minnesota.

CIGARETTES—Improved roller makes 20 for 9c. Facts free. Moberly, Box 911, Owensboro, Kentucky.

BE Independent: Exclusive home business, representing new line of nationally advertised products. High earnings. Pyramiding income plan. We supply everything. Send \$3.00 for complete plan and sample product. Money Back Guarantee. Midwest Distributors, Ludlow Falls, Ohio.

TWENTY Moneymaking Plans 25c. Levine's, 15-PS Boulevard Station, New York 59, N. Y.

MANY earn \$50.00-\$100.00 weekly spare-time. Guaranteed instructions \$1. (Refundable). Modern, Box 206, Sarasota, Florida.

FREE! Moneymaking homework opportunities galore. Write Soles Agency, Windsor, Missouri.

CASH in larger amounts than ever before paid for your constructive ideas. Learn how in "Cash for your Ideas" folio, \$1.00. Postpaid. Technicraft, Box 234, Cuba, Kansas.

\$15,000 PROFIT in one year possible, on \$5.00 weekly. Fabulous but true. Minimum of attention—respectable field. 15% profit can be guaranteed. Experience unnecessary. Proof, complete detailed plan, only \$1.00—Satisfaction or refund. Columbia Enterprises, 8203-S Grubb Road, Silver Spring, Maryland.

MAKE Big Profits clipping newspaper items for publishers. Instructions explain how. Particulars free. National, 81-N, Knickerbocker Station, New York.

MEN—Women! Start Money-Making Plastic Laminating Business at home in spare time. Material that costs 11c brings back \$2.58. No canvassing or selling but mail orders bring in \$20 a day. Write for full particulars. Free. Rush name on postcard to Warner, Room CL-3-H, 1512 Jarvis, Chicago 26, Ill.

MAKE Money Clipping Newspaper Articles For Publishers! Detailed plan. News-craft, PS-983-E Main, Columbus 5, Ohio.

MAIL newspaper clippings daily for cash. Ketchum's Advertising, 1058-B, Springfield, Illinois.

\$30-\$60 WEEKLY addressing envelopes. Instructions \$1, refundable. Reiss, 210 Fifth Ave., Suite 1102-S, New York 10.

BUY Wholesale. 30-80% discounts. Nationally famous brands. Typewriters, housewares, appliances, watches, furniture, musical instruments, cameras, tools, etc. Consolidated Distributors, Clifton 6, New Jersey.

## 38A BUY IT WHOLESALE

LARGEST Wholesale Supply Source In U.S. Get 23 free catalogs. Furniture, clothing, appliances, autos and accessories, farm equipment, tools, housewares, hobby supplies. Free details. Associated Wholesalers, Box 52-C, Burlington, Iowa.

BUY Wholesale. 30-80% discounts. Nationally famous brands. Typewriters, housewares, appliances, watches, furniture, musical instruments, cameras, tools, etc. Consolidated Distributors, Clifton 7, New Jersey.

BUY Wholesale! 25,000 Nationally Advertised Products. Get Amazing Dealer Catalogs. Complete Details Free. American Wholesalers, 1841-G Levee, Dallas 7, Texas.

WHOLESALE automobile catalog—discounts to 25% or savings to \$1200.00 or more. Also big multicolor wholesale catalog—housewares, appliances, binoculars, luggage, radios, photographs, recorders, projectors, typewriters, sewing machines, furniture, watches, jewelry. Name brands. Huge discounts. Postcard: Selbyco, Decatur 171, Ill.

100 BLADES \$1.00. Top quality double edged razor blades, individually wrapped, in display carton. Artee Sales, Box 794-BG, Chicago 90, Illinois.

BUY wholesale! Tremendous discounts! Write United Wholesalers, 1265-P Broadway, New York 1, N. Y.

ELECTRIC Guitars, amplifiers, wholesale. Free catalog. Carvin, PSW, Covina, California.

APPLIANCES, cameras, furniture, clothing, toys: Everything! Buy in your own state; save time, shipping charges. Directory of wholesalers all over U.S. Send stamped envelope. Thomson, 2470 Oak Street, Eugene, Oregon.

BUY Wholesale. 100,000 nationally advertised products. Appliances, cameras, sporting goods, housewares, watches, typewriters, tools, clothing, etc. Discounts to 80%. Buy-Rite, Box 258, Hawthorne 8, New Jersey.

## 39 FORMULAS, PLANS, ETC.

LATE Modern Manufacturing Formulas List Free. Chemical Service, Martville, New York.

FREE Large Formula catalog. Big Surprise. Western Chemical, Salem, Oregon.

SPECIAL Formulas for latest money-making discoveries. New! Good! Profitable! Valuable Literature Free! Miller, Chemist, 1517-N, Tampa, Florida.

MANUFACTURE profitable specialties. Free literature plus sample formula. Alpha-Midwest, La Porte, Indiana.

## 40 PLASTICS

LEARN Plastics Fabrication For spare time income. Low cost home training now available. Write for free booklet. Interstate Training Service, Dept. D-2, Portland 13, Oregon.

NEW Liquid Casting Plastic, clear, colors. Embed real flowers, coins, photos. New Manual shows fine things you can make at home and sell at big profit. Send 25c. Castolite, Dept. H-102, Woodstock, Illinois.

LAMINATING Supplies. Price List Free. Solomson, 46 Cornhill, Boston 8, Mass.

PLEXIGLAS — Any thickness — Clear — Colors — Cut to size — Clear Rods — Tubing. McClarin Plastics, P.O. Box 168B, Hanover, Pennsylvania.

PLASTICS! Casting, Molding, Modeling and accessories. Illustrated Catalog 25c. Castacraft Corp., Dept. C-65, P. O. Box 555, Palo Alto, California.

PLEXIGLAS. Square foot cost, 1/16"-\$1.20; 1/8"-\$1.52; 3/16"-\$1.86; 1/4"-\$2.21; 5/8"-\$3.23; 1/2"-\$4.36. Colors add 10%. Send 15% for postage. Aristocrat Plastics, 23 Sussex Avenue, Newark, N. J.

PLASTIC Laminating, Photos, Etc. Machines. Book Mark 35c. Burr, 330 East Center St., Kalamazoo, Mich.

PLASTIC Catalog—Includes Mold Making Casting Instructions—25c. Gel, Box 261, Union, New Jersey.

## 41 CHEMISTRY AND PHYSICS

CHEMICALS and apparatus for industrial, analytical and private laboratories. Catalog 25c. Dept. M-26, Biological Supply Co., 1176 Mt. Hope Ave., Rochester 20, N.Y.

**FREE** Scholarship. Major Course in Chemistry! Diploma. Also, valuable chemical library and chemicals. Catalog free. National School of Chemistry, Redwood City, Calif.

**CATALOG** with 3000 illustrations of laboratory and physics apparatus sent for \$2.00 Postpaid. Laboratory Materials Company, 1328 E. Hyde Park Blvd., Chicago 15, Ill.

**EXPERIMENTERS:**—"Bargains Galore Catalog,"—25c (Refundable). Hagenow Laboratories, Manitowoc, Wisconsin.

**ILLUSTRATED Catalog:** Chemistry, mineralogy, biology 25c. Tracey Laboratories, Evanston, Illinois.

**RADIOACTIVE Chemicals.** Learn how and where to buy. "The Isotope Index," important 100 page reference on Radiochemistry, only \$2.00 postpaid. Sec. Box 5686, Indianapolis 19, Indiana.

**ANALYTICAL Balance:** Sensitivity, 0001 grams, \$28.00. Time payment plan. Literature 10c. Royal Scientists of America, Rd. #4, Towanda, Pa.

**500 CHEMICALS** in small quantities. Apparatus, glassware. Catalog 25c. John H. Winn, 124P West 23 Street, New York 11, N.Y.

**SCIENCE** for Americans — Amateur science club. Chemical-equipment list; experiments; literature; awards. \$2.00 year dues. 25c list. 2525 Honolulu, Montrose, Calif.

**CHEMICALS,** glassware catalog. 25c. Laboratory Sales, Box 161-B, Brighton, Mass.

**ATOMIC Experiments.** 20 Fascinating isotopes experiments. Only 30c. Atomic Researchlab, 10717 Venice, Los Angeles 34, California.

#### 42 HELP WANTED REPORTS

**AMERICAN Overseas Jobs.** High Pay. Men, Women. Transportation Paid. Free Information. Transworld, Dept. 5C, 200 West 34th St., New York 1.

**JAPAN.** Many hi-paying jobs available. Full. Complete details \$1.00. Walts, Box 903, C.P.O., Tokyo, Japan.

**COPYRIGHTED Reports.** Best paying jobs with travel, adventure, promotions. Construction, aviation, shipping, oil fields, laborers, clerical, trades, supervisory, factory, unusual opportunities. Skilled-unskilled. Foreign—stateside. Men—Women. Only \$2.00 (\$2.25 Airmail). (C.O.D.'s Accepted), including registration-advisory service. Satisfaction guaranteed. Included free: Special reports on Alaska-Venezuela-South American opportunities—Husband & wife foreign jobs. Research Services, Suite 514-PS, Meramec Building, St. Louis 5, Missouri.

**FOREIGN Jobs—Latin America, Alaska, Canada, up to \$1500 monthly.** Up-to-date 1958 Foreign Service Directory gives complete information; hot list of firms hiring for Military and Civilian Construction, Aircraft, Oil, Exporters-Importers, Mining. How-When-Where to apply. 11th Successful year. \$1.00. Global Reports, Box 8873-P, Los Angeles 8, California.

**FREE Information—USA Overseas Jobs.** High Pay, Transportation—Futures Unlimited. Dept. P, 215 West 34th Street, New York City 1.

**HIGH Paying Jobs, Opportunities, foreign, USA.** All trades. Companies pay fare. For information write Dept. 57L, National Employment Information, 1020 Broad, Newark, New Jersey.

**JOBS Overseas!** Janecek Development Co., 109 Hub Station, New York 55, New York.

**JOIN the Merchant Marine.** For details write Box 8391, Jacksonville, Fla.

**JOBS galore in fabulous Florida!** Men, women; skilled and unskilled. Contacts, \$2.00. Leroy Parker, P.O. Box 8425, Jacksonville 11, Florida.

**IN & around Los Angeles—Jobs currently advertised, houses, rentals, business opportunities.** \$2.00 cash. A. L. Toomath, 557 E. Walnut, Pasadena, Calif.

**YOU want good overseas job?** Write—Employment Headquarters, 79-D Wall Street, New York 5.

#### 43 AGENTS WANTED

**YOUR own business—Suits \$1.50;** Overcoats 65c; Mackinaws 35c; Shoes 12½c; Ladies' Coats 30c; Dresses 15c; Enormous profits. Catalog Free. Nathan Portnoy Associates, 2109-J Roosevelt Road, Chicago 8.

**MAKE Money!** Take big profit orders, famous Fruit Trees . . . including sensational discovery—Starkrimson Delicious Apple! Also Dwarfs, shrubs, Roses, Vines. Sales outfit Free. Stark Bro's, Desk 30189, Louisiana, Missouri.

**AGENTS—300% profit selling genuine gold window letters; stores and offices.** Free samples. Metallic Sign Letter Co., 1217-E West Newport, Chicago.

**GOLD or Silver letters, numbers.** Windows, Doors, Trucks 1" to 6". 500% Profits—Free Samples. Atlas-U, 544 West 79th, Chicago 20.

**IF you're interested in making money in selling, see the hundreds of exceptional opportunities in Salesmen's Opportunity Magazine.** Send name for your copy, absolutely free. Tell us what you're selling now. Opportunity, 848 N. Dearborn, Dept. 18, Chicago 10, Illinois.

**EVERY man a prospect.** Request free sales kit showing line of belt buckles, individualized with customer's name and emblems also cap badges for trucking, bus, taxi, police, firemen. Choice 3000 emblems. Hook-Fast, Box 1425PS, Providence, Rhode Island.

**MEN & Women.** 122% Profit selling Nationally Advertised famous Turtle Wax-Plastone Products for car and home. Finest quality made. Unconditionally Guaranteed. Super fast and easy to use. Amazing 30-second demonstrations. Products now sold in over 100,000 stores around the world. Choice restricted territories open. Large, continuous all-year earnings. Unlimited sales field. This is the first sales opportunity in 10 years with our company. Act Now! Send Today for Free details. Plastone, Dept. 92-8, Chicago 51, Illinois.

**AMAZINGLY Easy Profits from exciting new Christmas Cards.** 21-Card Assortment pays 75c per box—\$75.00 on hundred. Gift Bonuses besides. Outstanding selection Cards, Novelties, Free Imprint Album. Samples on approval. \$1.25 Gift Offer. Creative, 4401 Cermak, Dept. 511-J, Chicago 23.

**ANYONE Can Sell famous Hoover Uniforms** for beauty shops, waitresses, nurses, doctors, others. All popular miracle fabrics—nylon, dacron. Exclusive styles, top quality. Big cash income now, real future. Equipment free. Hoover, Dept. K-101, New York 11, N.Y.

**RUN a spare-time greeting card and gift shop at home.** Show friends samples of our new 1958 Christmas and all occasion greeting cards and gifts. Take their orders and earn to 100% profit. No experience necessary. Costs nothing to try. Write today for samples on approval. Regal Greetings, Dept. 86, Ferndale, Michigan.

**SHOW Thrilling \$1 Values in newest Christmas Card Assortments.** Stationery, Gifts. Keep up to 50c of every dollar. Big line; complete price range. No experience needed. Get Assortments on approval; Personal Portfolios Free; \$1 Gift Offer. Cardinal, 1400 State, Dept. 60-R, Cincinnati 14.

**I'LL send you free stocking sample newest advancement in hosiery since discovery of nylon.** Full-length; stays up without supporters; amazingly comfortable. Patented. Make money fast introducing to friends at 70c a pair less than Nationally Advertised price. American Mills, Dept. 657, Indianapolis, Ind.

**BEAUTIFUL Feather Pictures!** Free Details. Sample 20c Stamps. Apartado 1668, Mexico 1, D.F.

**CALENDARS.** Advertising Novelties, Matches. All styles, including Religious. Varnished 12 sheet. Girls. Hundreds of Advertising Novelties. Book Matches, etc. Fleming Calendar Co., Promotional Division, 6539 Cottage Grove, Chicago 37, Ill.

**MEN-Women Agents:** Sensational new moneymakers — Beautifully hand-painted plastic personalized photo enlargements, compacts, rings, bracelets, lockets, etc. Simply take orders, pocket 40% commission—we deliver and collect. Sales outfit free. Novelco, 3343 North Avenue, Chicago 47.

**WILL you wear new suits and topcoats without one penny cost and agree to show them to friends?** You can make up to \$30.00 in a day even in spare time, without canvassing. Progress Tailoring Co., 500 South Throop St., Dept. C-326, Chicago 7, Illinois.

**CHRISTMAS Cards—impressive album of personal and business designs—with customer's name imprinted on both cards and envelopes.** Deluxe cards that pay Deluxe commissions. Prices: 25 for \$3.95 and up. Men or women, club groups or church organizations can easily earn \$300 to \$500, plus bonuses. Old established manufacturer furnishes album of sample cards and selling kit. You can take orders for better Christmas cards! Experience unnecessary. Write Process Corp., Dept. 6, 1954 S. Troy, Chicago 23, Illinois.

**GOLDMINE** of 600 money-makers. Free copy. Specialty Salesman Magazine, Desk 6B, 305 North Michigan, Chicago 1, Ill.

**CASH commissions at once, taking orders for magazines every family wants!** No experience needed. For Free money-making kit, with everything you need, write McGregor Magazine Agency, Dept. 330, Mount Morris, Ill.

**SEND** only 25c for 50 fine Christmas Cards—introductory offer to prove how easily you make \$25 to \$200 showing friends our thrilling new Christmas Cards and Gifts. Free Personal Album. Assortments on approval included. Boulevard, 235 S. Wabash, Dept. 557-G, Chicago 4.

**EXCLUSIVE Line of Personal Initialed buckles, belts, cap badges, 3000 emblems.** Hook-Fast, Dept. PS, Roanoke, Va.

**BUSINESS** of your own. Earning potential as high as \$40,000 annually. Issued on \$12,500 base. No merchandise to buy. Send for free explanatory booklet. Harrell & Company, Box 8-DD, Louisville, Ill.

**BIG Profits** — Stamp Social Security Plates Key Protectors. Sample—50c. Catalog Free. General Products, 182-PS State, Albany 10, N.Y.

**NEW Invention patented low cost consumer product no competition million dollar potential.** Write Austin Inc., 3440 Main, Hartford, Conn.

**CRAZY Cards.** Two sets 25c. Catalog free. Dohn-GG-Marks, Broadview, Ill.

**WILL You test new items in your home?** Surprisingly big pay. Latest conveniences for home, car. Send no money. Just your name. Kristee 30, Akron, Ohio.

**EARN \$12,000 Yearly**—only two sales daily. World's Best Seller, The Holy Bible. (Illustrated) Protestant or Catholic. Margaret's, P. O. Box 92, Hazleton 6, Pa.

**START Your Own Business On Credit** (U.S. and Canada). Your own boss. 1425 Dealers sold \$5,000 to \$32,000 in 1957. We supply stocks, equipment on credit. 200 home necessities. Sales experience unnecessary. Pleasant profitable business backed by world-wide industry. Write Rawleigh's, Dept. H-U-PSC, Freeport, Ill.

**FREE Sample!** Beautiful Feather Pictures. Sylvial, Apartado 9036, Mexico 1, D.F.

**EASY handwork makes fast-selling articles.** Sample free. Sunmade Company, Brockton 64, Massachusetts.

**NEW car thief Signal!** Lightning Seller. Samples sent on trial. Northwest Electric, 92, Mitchell, South Dakota.

**TAKE easy orders for new Christmas card and All Occasion assortments.** Make \$50-\$250 Extra Money plus Bonus. Feature assortments on approval. Free Album Personal Christmas Cards and Stationery. Rush name, address for everything needed to start, and money-making plans. New England Art Publishers, North Abington M-87, Mass.

**TAKE over your area as a Service Distributor** keeping retail stores supplied. Our nationally advertised 27-year-old line gives you 66½% mark-up. Tremendously successful moneymaking plan. Write K. T. Harris, c/o Novo, 1166 Milwaukee, Chicago 22, Illinois.

**1.850% PROFIT!** Guaranteed sample, plan, \$5. Millions Sold. Daniel Rowan, 3514 Shelmirep, Phila. 36.

**\$1.00 PROFIT** selling \$2.95 photo enlargement offer. Allen Studio, Reigler Bldg., Little Rock, Arkansas.

**BEAUTIFUL Stones.** Sell on Sight. Little Investment. Details. Capt. William Lewis, Tampa 9, Florida.

**SHINE Shoes Without "Polish."** New invention. Lightning seller. Shoes gleam like mirror. Samples sent on trial. Kristee 51, Akron, Ohio.

#### 44 HIGH-GRADE SALESMEN

**MAKE Extra Money.** Cash commissions. Everybody buys easy-to-sell Advertising Book Matches. Union Label. Big variety—Glamour Girls, Scenics, Hillbillies. Powerhouse selling kit Free. Steady repeat business. No experience necessary. Superior Match Company, Dept. P-858, 7528 S. Greenwood, Chicago 19.

**AD Matches!** Sell amazing designs—10, 20, 30, 40, and 240-light book matches. Bigger spot cash commissions; every business a prospect. Low prices for high quality. Repeats. Start without experience: men, women; full, part-time. Buy nothing. Sales kit furnished. Match Corp., Dept. PS-98, Chicago 32, Illinois.

**BIG Cash Commissions!** Complete line 230 shoe styles, also jackets. Postcard brings you free kit! Mason, Chippewa Falls, Dept-K-114, Wisconsin.

**FAST Moneymaker**—New Development—Uniforms advertise 24 hours a day. Exclusive with Master. Name—emblem glow in dark. Free outfit. Master, Dept. H-11, Water, Ligonier, Indiana.

**SELL Decals, Bumper Signs, Top Commissions**. Box 2223, Paterson, New Jersey.

**DISTRIBUTORS**. Sell Royal Jelly 50 mg. tablets containing 32 food supplements, etc. Big discounts. Nu-Life Products, 2420-S, 77th Avenue, Oakland 5, California.

#### 45 EDUCATIONAL & INSTRUCTION

**BOOKKEEPERS!** Increase your earnings! Operate your own simplified "Dollar-A-Week" Bookkeeping and Tax Service. Full or spare time. Details Free. No obligation. Ellis, Box 203, Cedar Grove, North Carolina.

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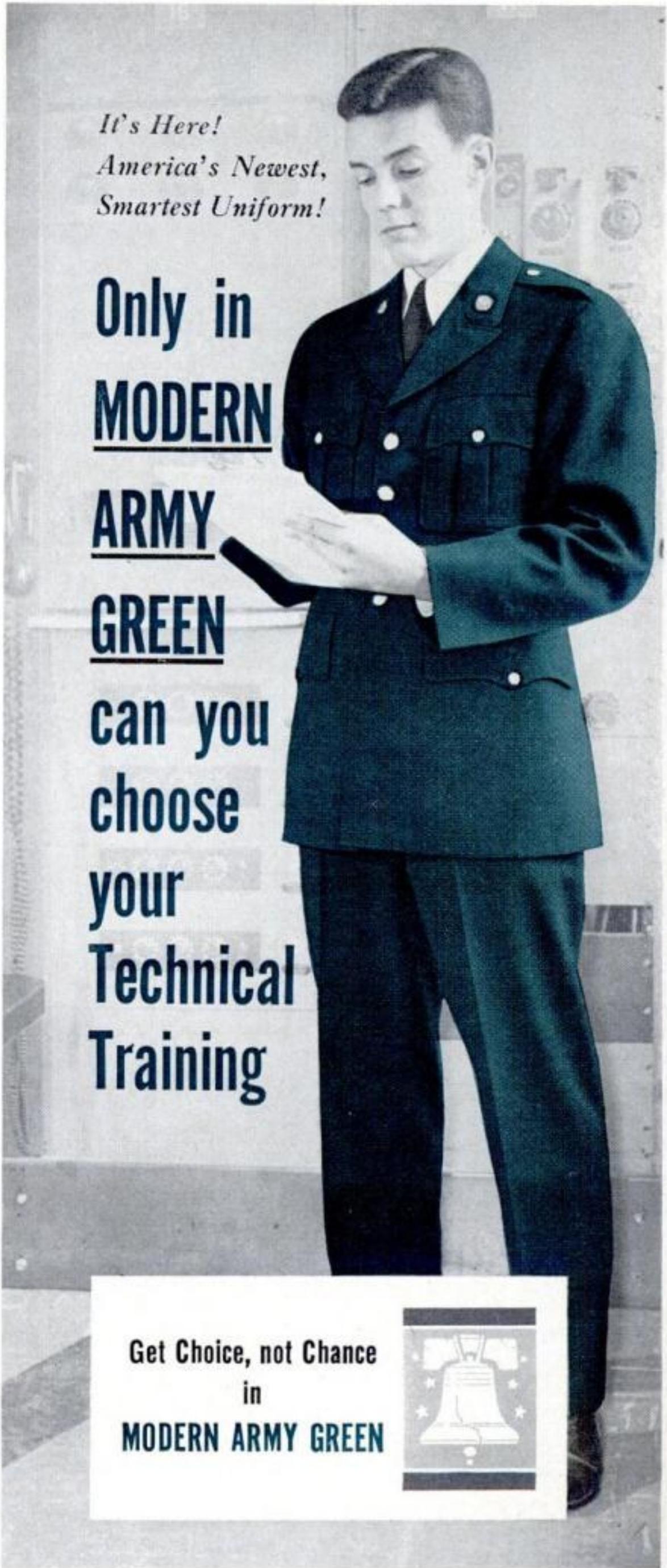
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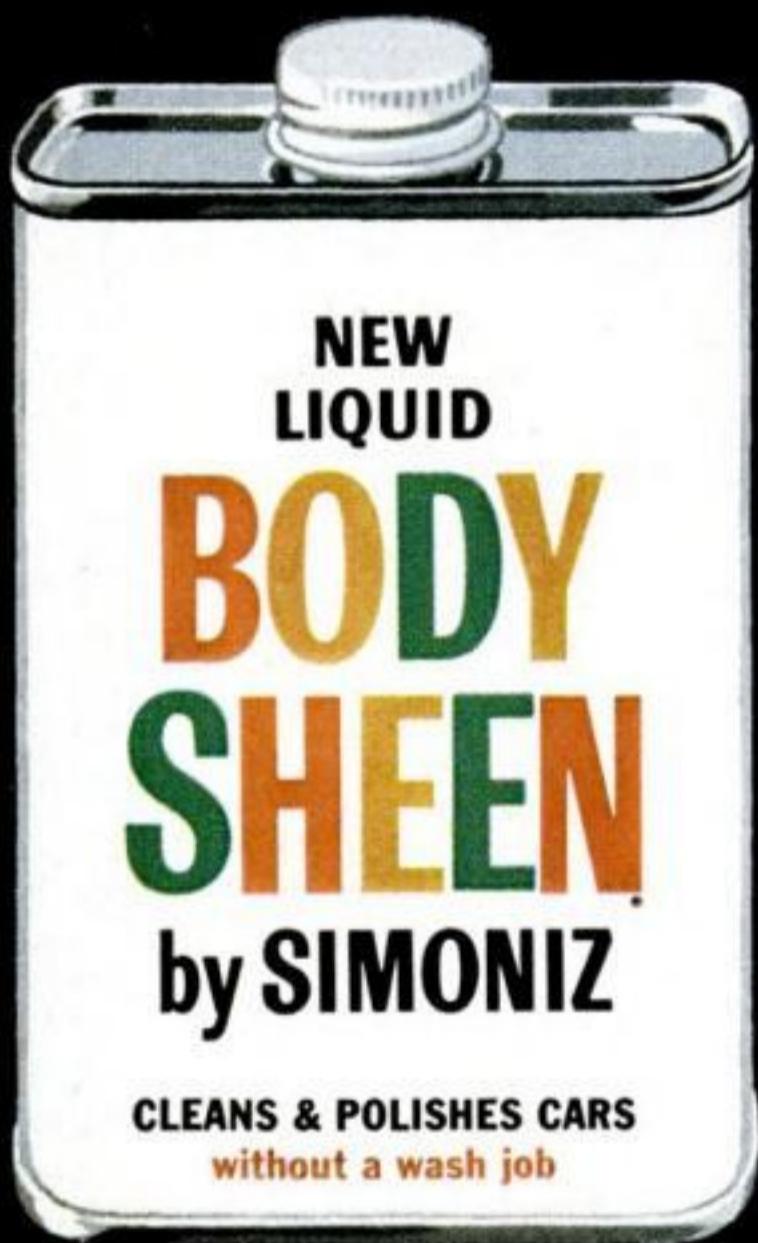


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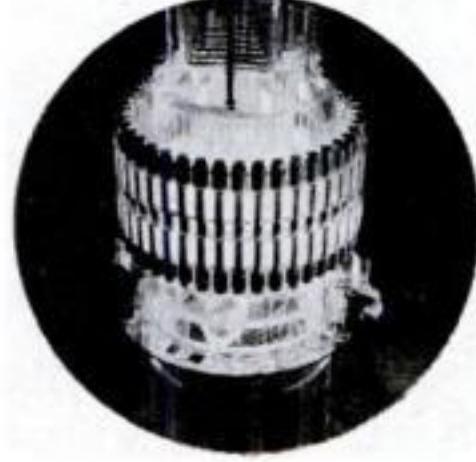
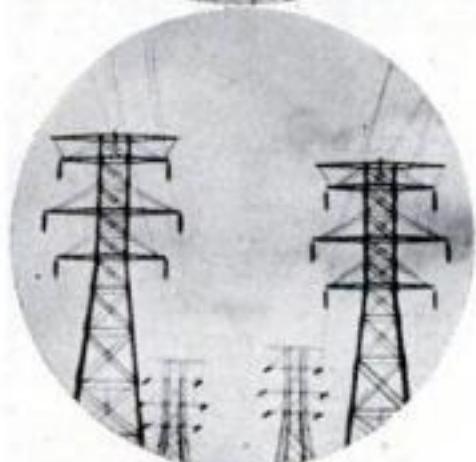


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# Window on Tomorrow

This month POPULAR SCIENCE begins an important new series of articles. They will take you to the laboratory benches of the men who are making your future, to see for yourself the vistas these pioneers of science are exploring.

What in the decade to come will reshape your life as radically as the startling developments of the past 10 years? What new discoveries will repeat the impact of television on your daily habits? Of cheap and convenient air transport on travel? Of antibiotics on your enjoyment of a long life?

The scientists know now. Already they are at the frontier. These articles will show you their radical methods and tools for tomorrow: ideas that harness gigantic forces to rebuild the earth itself, sustain man's health at its peak, insure food and space for everyone, plumb the deepest mysteries of the universe.

For a glimpse through the window on tomorrow, turn the page. There you will learn of science's newest gifts: inventions that will electrify the world, literally and figuratively, by supplying the power of electricity more abundantly and more conveniently than ever before.

# ELECTRICITY WITHOUT

BY MARTIN MANN

*A triple breakthrough in research puts reality made directly from heat or chemicals.*

**A**LANKY young M.I.T. professor sketches a vacuum tube on a pad. Eyes sparkling confidently, voice softly accented by his native Athens, he describes tomorrow: "This is a power package. Just a tube—maybe as big as an old-fashioned radio tube—and a source of heat. No steam, no turbine, no generator. Plug into the tube and out comes electricity—a thousand watts!"

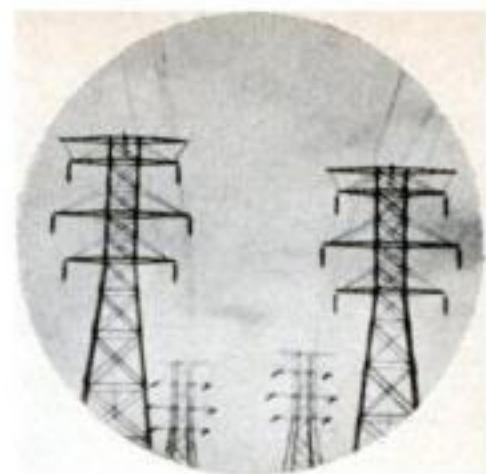
"We can even build the heat inside the tube. A radioactive capsule the size of a pencil eraser would throw off heat enough to make it work."

In laboratories around the world, scientists are perfecting radical new ways to produce electricity—ways that will save money and natural resources, add convenience, and make long-cherished dreams come true.

Would you—like the Army—want a silent car with all the engineering advantages of electric drive plus the beauty of its own electric source under the hood?

Even a quiet, self-powered, electric lawn mower "would be a boon," remarks one scientist in the staid pages of the *Proceedings of the Institute of Radio Engineers*.

How about a table-top electric plant for farmhouses? Or a still smaller one for camping trips? A TV set running off a kerosene lamp



# GENERATORS

*into an old, old dream: Electrical power  
You may get to drive that electric car yet*

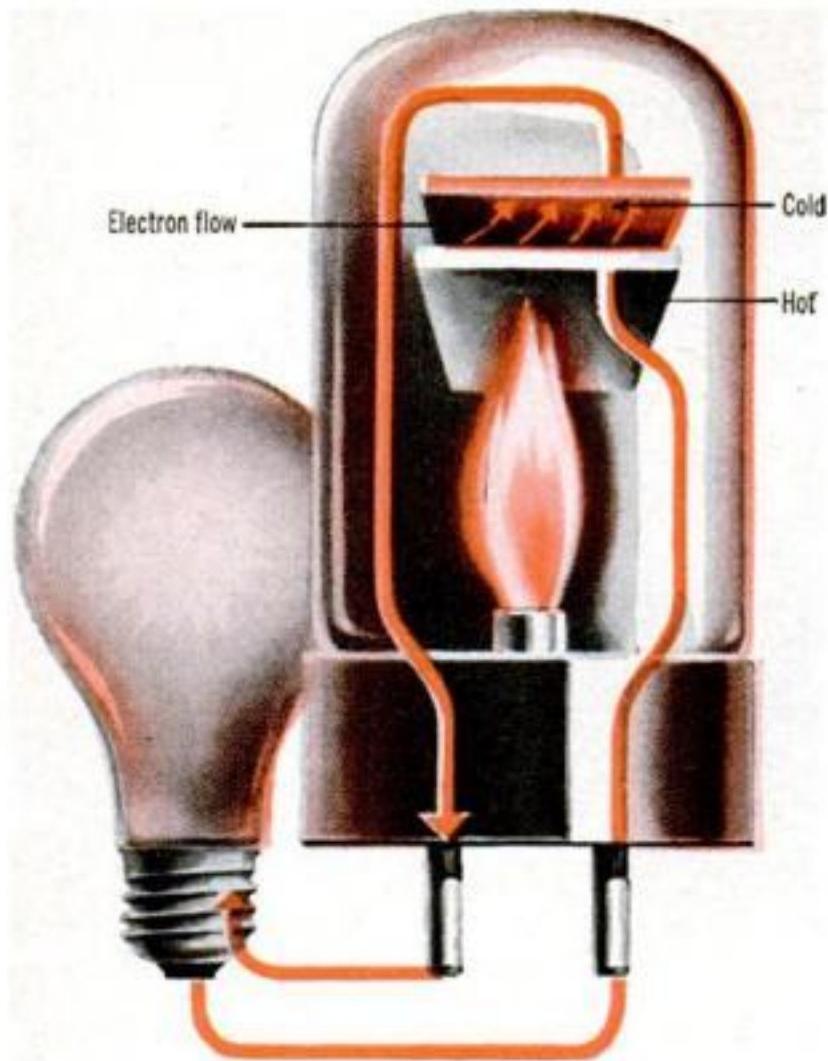
or propane torch? And more significant than these delightful devices: The efficiency of utilities' big central stations can be raised—perhaps even doubled—to assure cheap and plentiful electricity at your outlets.

The power-plant-inside-a-vacuum-tube exists now. Dr. George N. Hatsopoulos—the ink is hardly dry on his Doctor of Science degree, but he is already an assistant professor at M.I.T. and president of the Thermo Electron Engineering Corp.—has built several. They are not just laboratory curiosities. They pour out real current, efficiently.

Equally important, other scientists have done much the same thing.

In the big General Electric Research Laboratory, mild-mannered, gray-haired Dr. Volney C. Wilson displays his version of the heat-to-electricity tube. It looks much like Hatsopoulos', but works with cesium gas instead of a vacuum. Upstairs in the same building, big, jovial James E. Beggs has still another type. There on Beggs' lab bench sits a propane torch, its flame playing against a ceramic-and-metal vacuum tube the size of a quarter. The tube is generating electricity.

And there's more. Experts on semiconductors—the stuff in transistors—are also building heat-to-electricity and sunlight-to-electricity converters. Chemists, taking a completely different tack, pro-



**Power from a tube:** Latest model of Hatsopoulos' vacuum-tube heat converter (above) achieves 13-percent efficiency (for experiments, heat is supplied electrically). At least two other versions of the same device are being developed independently by General Electric scientists Volney C. Wilson and James Beggs.

duce electricity—very, very efficiently—from the direct combination of hydrogen and oxygen.

It all adds up to an exciting picture of a new era in power production, the result of several nearly simultaneous breakthroughs in scientific discovery. You see it in the confident optimism of the scientists. You sense its importance in their chariness with details, their occasional refusal to say anything. This is Something Big, vital militarily, worth millions commercially. (Was it Hatsopoulos or Wilson who first hit on the trick that makes vacuum tubes gush power? A patent fight may be brewing here.)

**Decline of the dynamo?** For three-quarters of a century the world's electricity has come from a mechanical device: a bundle of wires spinning inside another bundle of wires, the movement of one relative to the magnetism of the

other forcing electrons to move. Batteries are important, sure, but only when plugging into a dynamo is not feasible.

There's nothing wrong with dynamos as machines. They pump out rivers of amperes, high voltage or low, AC or DC. They last a long time, are highly efficient.

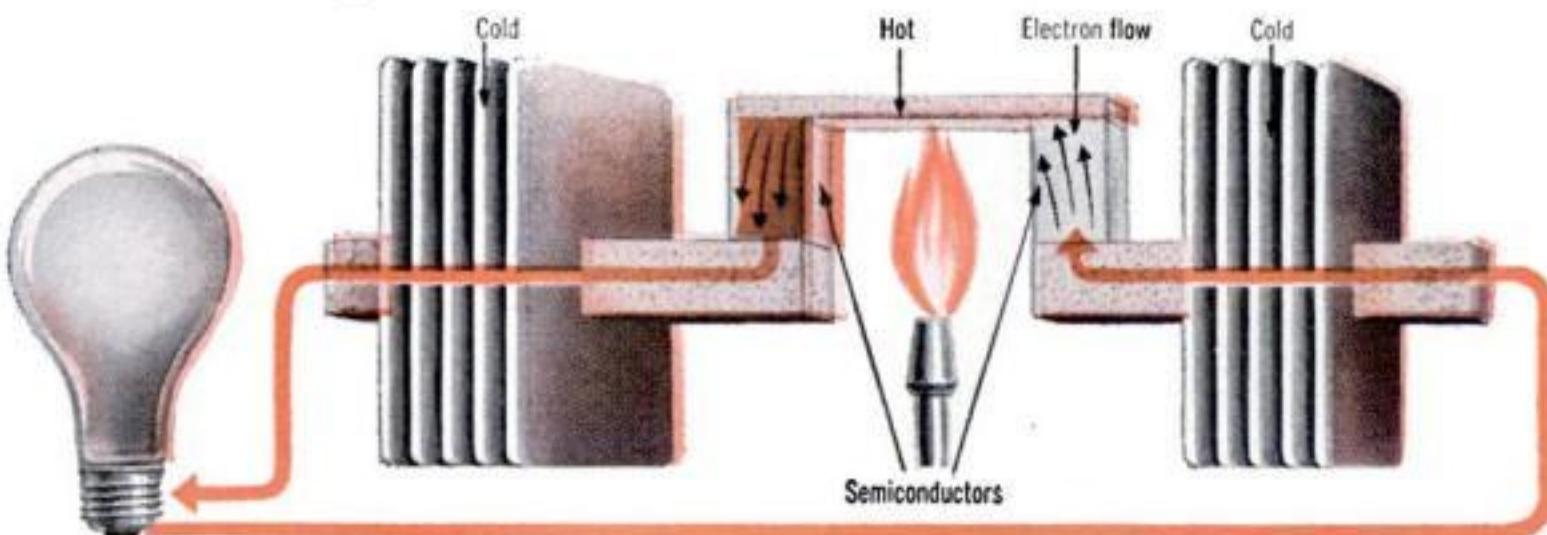
The trouble is driving them. You use water power (the money those dams cost!). Or you go all around the barn: dig up coal, burn it to make steam, let the steam spin turbines, finally get the turbines to drive the dynamos. (Atomic fuel does not help much: You simply burn uranium or deuterium instead of coal, at higher cost.) Thanks to intensive engineering, this involved coal-steam-turbine-dynamo system can produce electricity remarkably cheaply (a few tenths of a cent per kilowatt-hour) and efficiently (40 percent, very high for a heat system). It can be improved further, but not much.

**The better ways.** There are dozens of simple ways to conjure up electrons, even if you don't count scuffing shoes on the rug or harnessing electric eels. All (including the exciting "new" ideas) have been tried. None ever panned out—until now. What changed the picture was new knowledge of atoms, molecules and crystals, and of the way they let go of their electrons.

**Heat to electricity.** You have heard of the thermocouple. It is a loop of two different wires joined at their ends. Heat one joint, cool the other, and electricity flows.

It just barely works: minute currents, less than one-percent efficiency. Still it is useful for instruments, and Bell Telephone is trying out a battery of the things to power a transistor amplifier (the couples are woven into mats and deliver one watt for a year on a single tank of bottled gas; the whole works—gas tank included—fits inside a hollow steel telephone pole). The Russians use the same idea for a kerosene-powered radio. It's no joke; they put thermocouples in the kerosene-lamp chimney.

A basic defect cripples thermocouples: Metals conduct heat too well. It's diffi-



**Power from a crystal:** Transistorlike semiconductors also convert heat directly into electricity efficiently. Two crystals—one "doped" to be electron-rich, the other

to be electron-poor—are connected and heat is applied to the joint while the other ends are cooled. Military security now cloaks much of this research.

cult to keep the hot end from warming up the cold end—and the temperature difference is what makes the thing work.

Hatsopoulos pondered this while a teen-ager in wartime Athens (he was building radios secretly in his cellar for the Greek underground). Why not build a thermocouple having part of the loop in a vacuum? Little heat could cross the vacuum.

**Learning the trick.** This kind of "thermocouple" is a diode, the two-element vacuum tube standard in radio work. It can indeed convert heat into electricity—but only after some tricks are learned. The fundamental trick had eluded a number of brilliant researchers for decades. It is this:

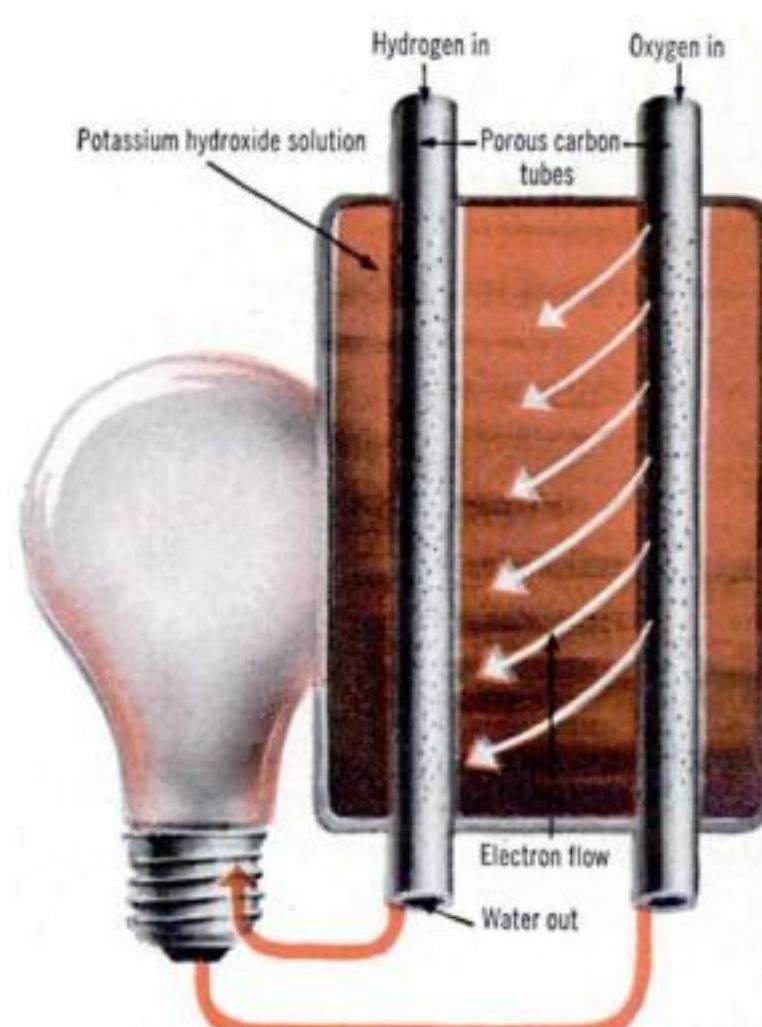
The diode has to be built backwards. Its electron-emitting element (cathode) must be *less* willing to give up electrons than the electron-receiving element (anode). Sounds wrong? Energy bookkeeping explains why it is right.

It takes a certain amount of energy—heat in this case—to boost an electron out of a metal. "Lift it over the top of the wall," physicists say. If the electron falls back into the same kind of metal, it loses as much energy as it had gained getting out. No energy is left over for useful work. You can't make money that way.

But suppose the electron falls back into a different kind of metal, one that has a lower wall (that means a metal

more willing to give up electrons, too). Falling this shorter distance, the electron loses only part of the energy it had gained getting over the high wall. The rest of the energy is left over, and can be drawn off as work-producing electricity. You're in business.

Of course, there are losses inside the



**Power from gases:** Chemical combination of hydrogen and oxygen to form water releases electrons for electric current. Reaction takes place at electrodes in electrolyte solution, but neither is used up as they are in ordinary chemical battery. Fuel comes from outside cell. Sketch shows a National Carbon Co. unit.



**Dr. Volney C. Wilson**, key A-bomb scientist now at GE, was first to announce heat-to-electricity vacuum tube.



**James E. Beggs**, developer of GE's tiny ceramic vacuum tubes, built small heat converter shown above.



**Dr. George N. Hatsopoulos**, of Greek engineering family, worked out heat converter independently as thesis project.

tube that cut into your profit. The most important is caused by space charge. Electrons emitted from the cathode collect in a cloud near the cathode. Since like charges repel, the space-charge cloud hinders the flow of electrons from cathode to anode.

Hatsopoulos and Beggs get around space charge by placing cathode and anode very close together. The electrons run into the anode before they can be repelled by the space-charge cloud. Building such tubes is difficult—the cathode and anode must be less than a thousandth of an inch apart without touching. But it can be done. (Beggs is an expert at this—he developed the smaller-than-transistor ceramic vacuum tubes.)

Wilson licks space charge in a different way, by putting cesium inside the tube. The gaseous cesium atoms lose electrons to the cathode, becoming positively charged. These positive ions then neutralize the negative space-charge cloud.

**Without the vacuum.** Anything vacuum tubes can do, solid components can do, maybe better. Practically all rectifiers in radios and TV sets are now solid selenium or silicon. Solid germanium (transistors) is taking over the amplifying jobs. So it's no surprise to find that

semiconducting solids will turn heat into electricity.

They work like the vacuum tubes. Heat energy shakes electrons loose from their positions in the crystal. The electrons travel to the cold end and drop into new positions, retaining enough energy to perform work as electricity.

The solid crystals so fertile with electrons are exotic materials like bismuth telluride and lead telluride. But how they blossom with electricity! You can get half an ampere (at very low voltage) from a single bismuth telluride-bismuth unit by keeping the hot end only 36 degrees warmer than the cold end. There's that much temperature difference between the inside and outside walls of your house on a winter day!

Much semiconductor research is military. Admiral A. M. Morgan has told Congress: "We are on the verge of a breakthrough . . . which will enable us to get efficiencies comparable to conventional power plants. In submarines, it would eliminate almost all noisy machinery. We should have something definite on this in three years."

The Navy will say nothing more. But it is common gossip in the industry that the research contracts amount to millions.

[Continued on page 206]

# New Fire Engine Drives Like the Family Car

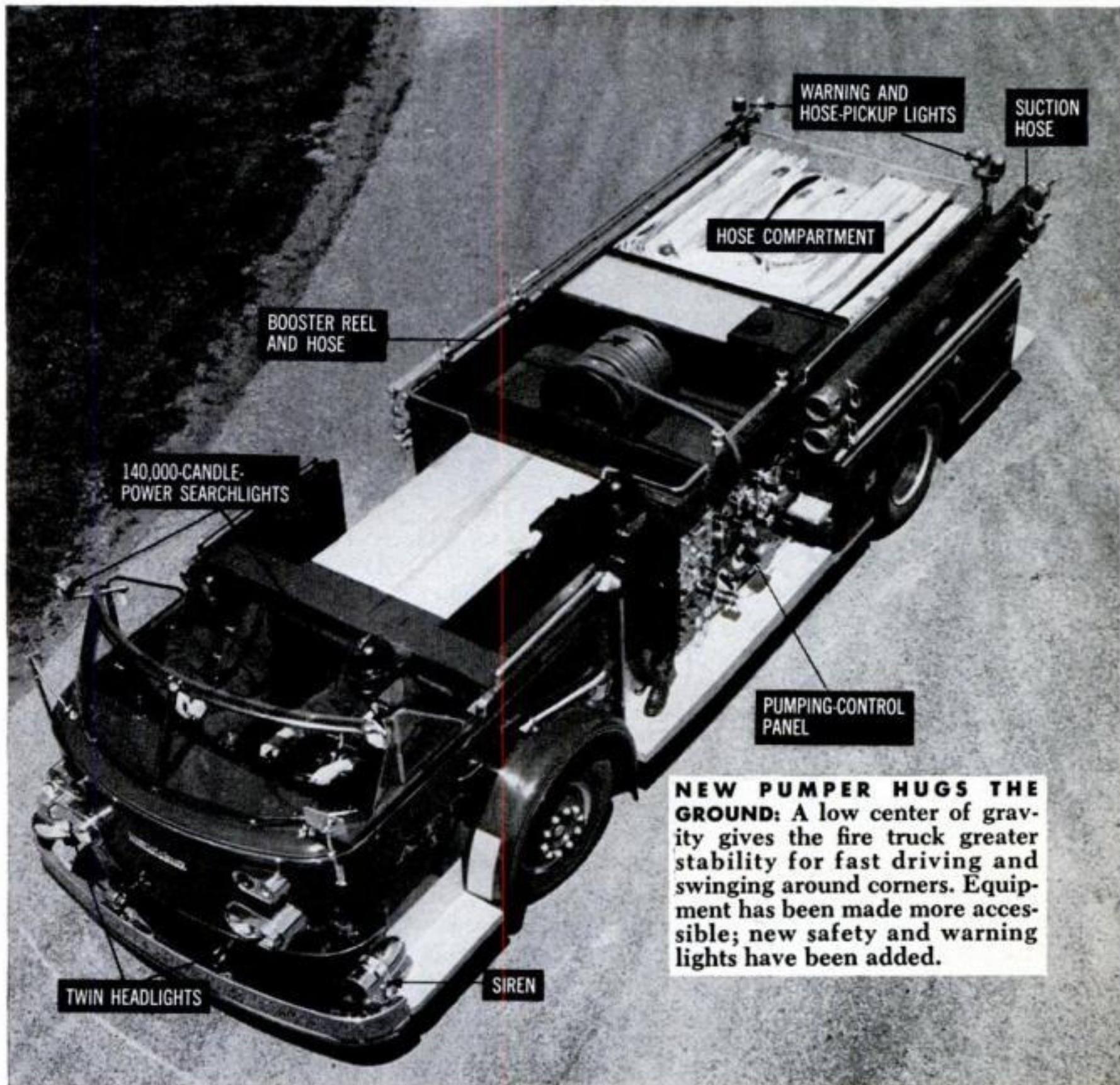
By Herbert O. Johansen

**Volunteer firemen have a treat in store when this big red wagon answers the siren's call**

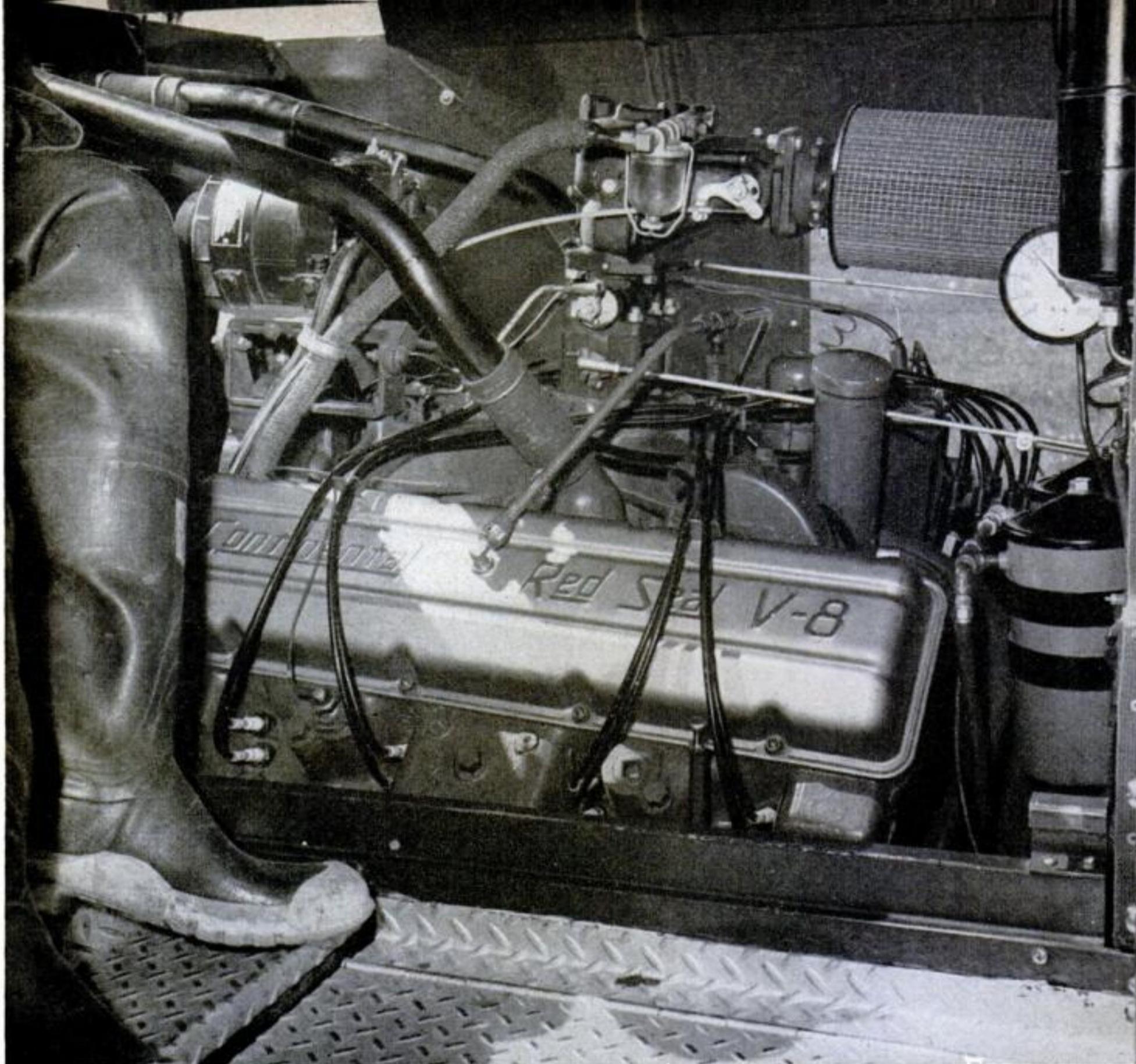
AUTOMATIC transmission, the first real news in fire engines since the cab-ahead-of-engine design made its appearance in 1947, is now making its debut in an American LaFrance pumper

that's equipped with a torque converter.

Why the development didn't come sooner is hard to explain. But it *had* to come. Of the million firemen in this country, 875,000 are unpaid volunteers, most of whom may have to drive the local company's fire apparatus at a moment's notice. And many of the younger men who are filling the ranks of volunteer firemen simply don't know how to use a



**NEW PUMPER HUGS THE GROUND:** A low center of gravity gives the fire truck greater stability for fast driving and swinging around corners. Equipment has been made more accessible; new safety and warning lights have been added.



**CONTINENTAL 300 HP. V-8 ENGINE** has two sets of spark plugs that can be switched from the cab. Quick starts are aided by individually ported intake manifold that gives controlled dis-

tribution and equal supply of fuel to all cylinders. Carburetor is specially calibrated so that the engine will not load up or foul its plugs during long periods of idling.

standard gearshift properly, if at all. They are prone to clash gears and ride the clutch, which is especially bad for equipment that must be ready to go at all times.

The new vehicle has power brakes and power steering—even a wraparound windshield.

At Elmira, N. Y., home of the American LaFrance Corp., a city fireman was behind the wheel posing for a picture. PS photographer Bill Morris asked him to reposition the truck. The man looked puzzled—any fire apparatus he'd ever driven had a gearshift. "Drive it like your own car," someone shouted.

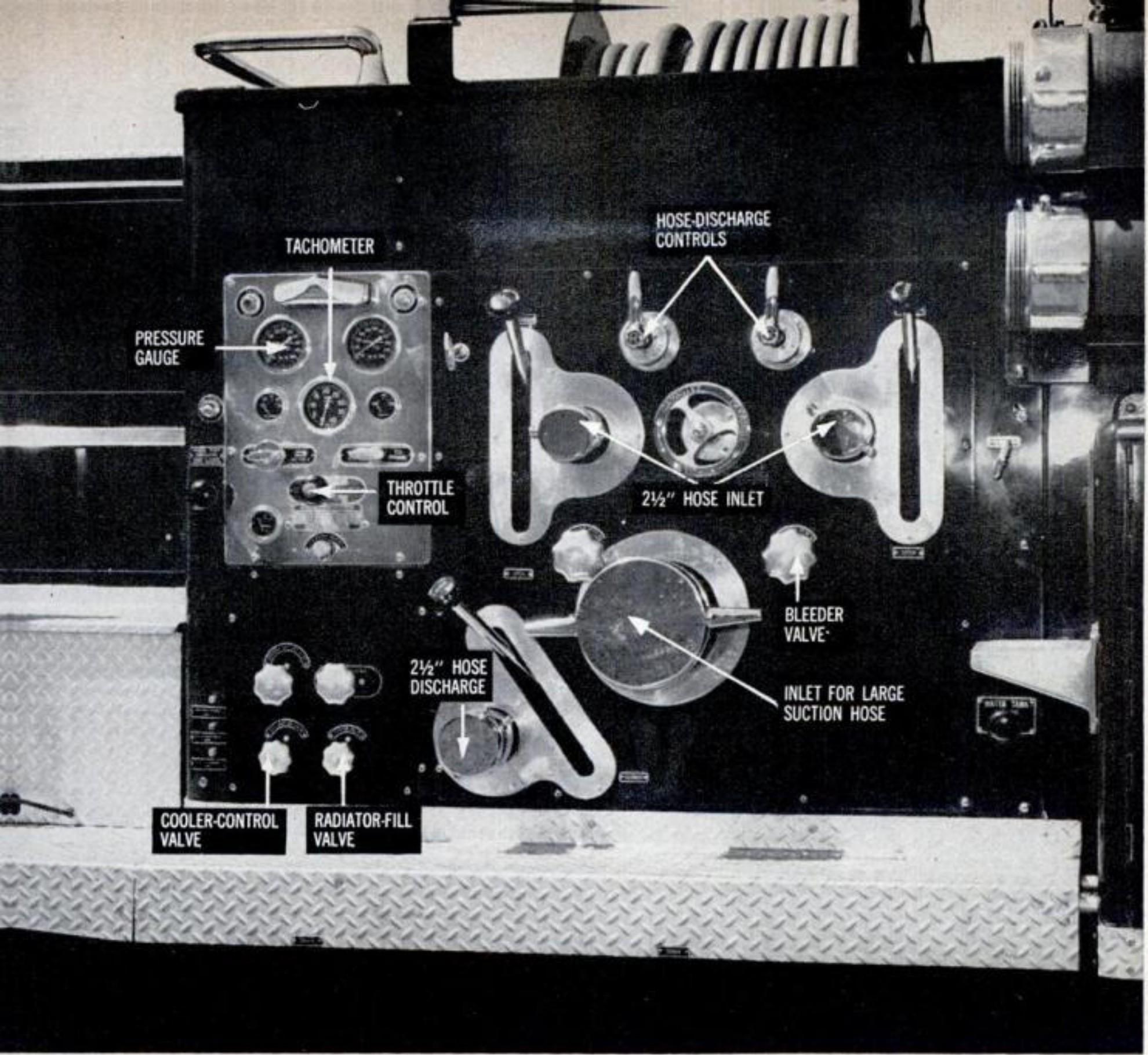
With a dubious look, the young fireman started the engine. He backed up, then went ahead, swung around in a tight

circle. Finally, with bell clang and siren shrilling, he came to a stop at a spot indicated by Bill.

He grinned. "This is for me. It even turns as short as my car."

The front wheels' wide tread gives them a wide turning angle. Later we measured the turning radius—23 feet, about that of a large sedan.

When fire engines like this one—whether from American LaFrance, Seagrave, Mack or Pirsch—start reaching the more than 17,500 volunteer fire companies (out of a total of 19,000 fire departments in the country), the rule that "the first guy at the fire house gets to drive" will be more zealously guarded than ever.

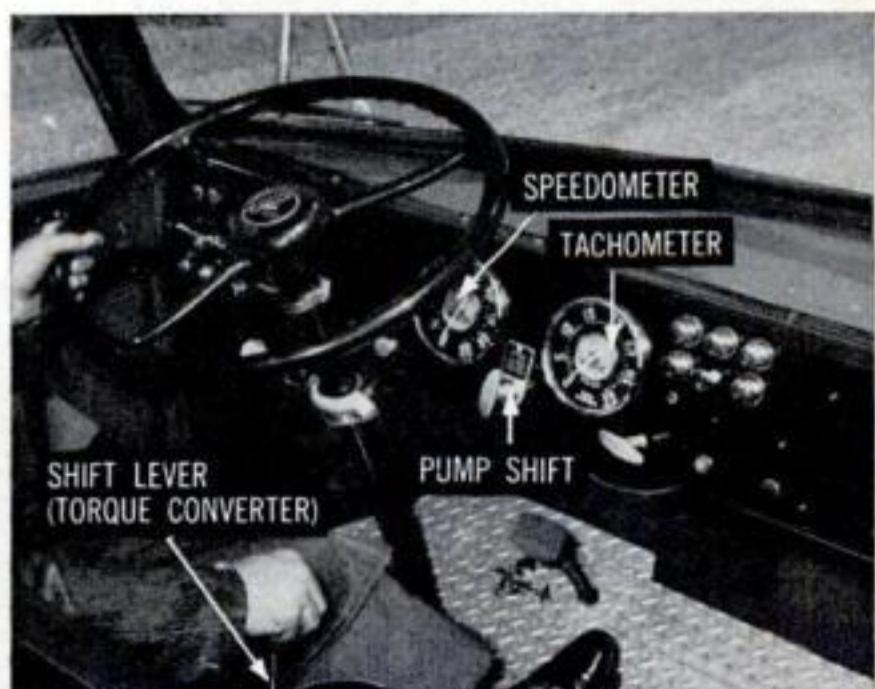


**CONTROL PANEL** is the nerve center of a pumper. Micrometer adjustment controls engine speed while pumping. If radiator temperature rises above 180 degrees, a cooler-control valve sup-

plies cool water to the engine. A governor prevents build-up in any one hose of too much water pressure. A bleeder valve drains the hose before it is uncoupled and stowed away.



**WIDER CAB**, 71 inches between doors, gives elbow room to three husky firemen. Wrap-around windshield is of safety plate glass. It's high, to give plenty of wind protection.



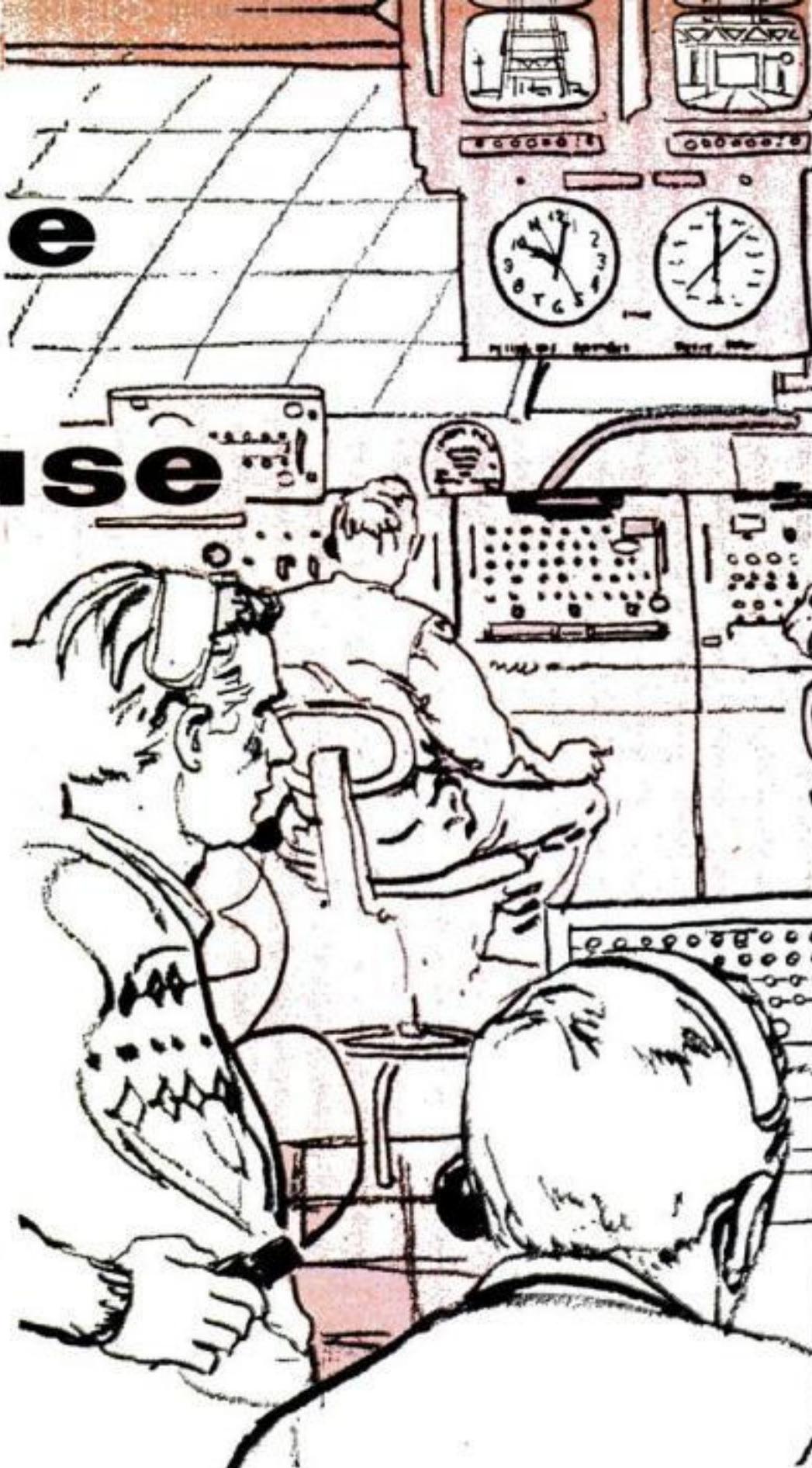
**INSTRUMENT PANEL IS SIMPLE**—for a fire engine. The driver's seat is separate and adjustable. Tachometer, for use during pumping operations, indicates engine r.p.m.'s.

END

# Inside the Atlas Blockhouse

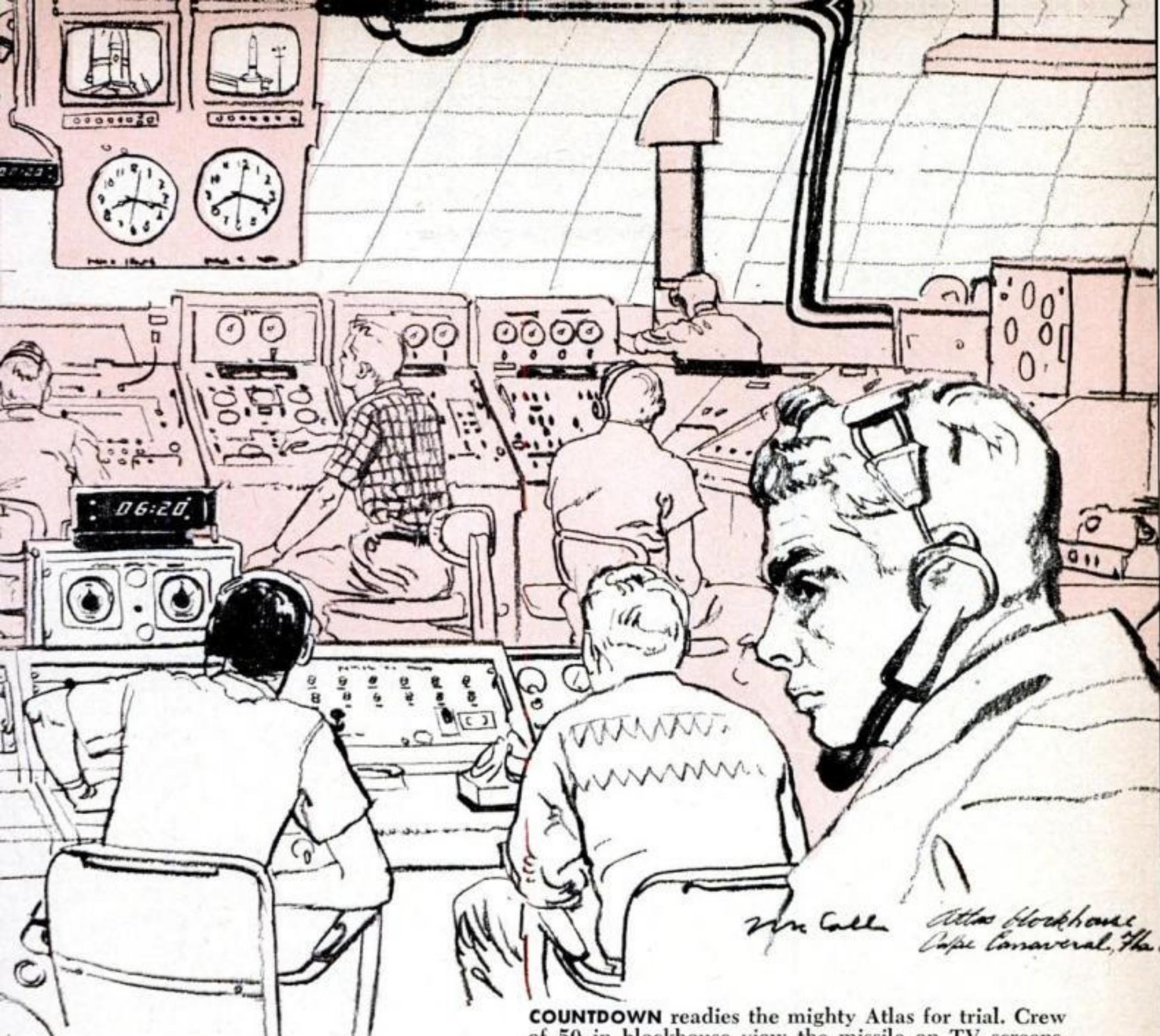
**The concrete fortresses from  
which they launch the missiles  
of the Space Age are as  
impregnable as man can build**

**By Alden P. Armagnac  
Drawings by Bob McCall**



STRANGE fortifications have risen from the palmetto-dotted sands of Cape Canaveral in Florida. The smaller ones, squat concrete blocks with windowed slits, call to mind the bastions of a Maginot or Siegfried Line. The big-





Mr. Call

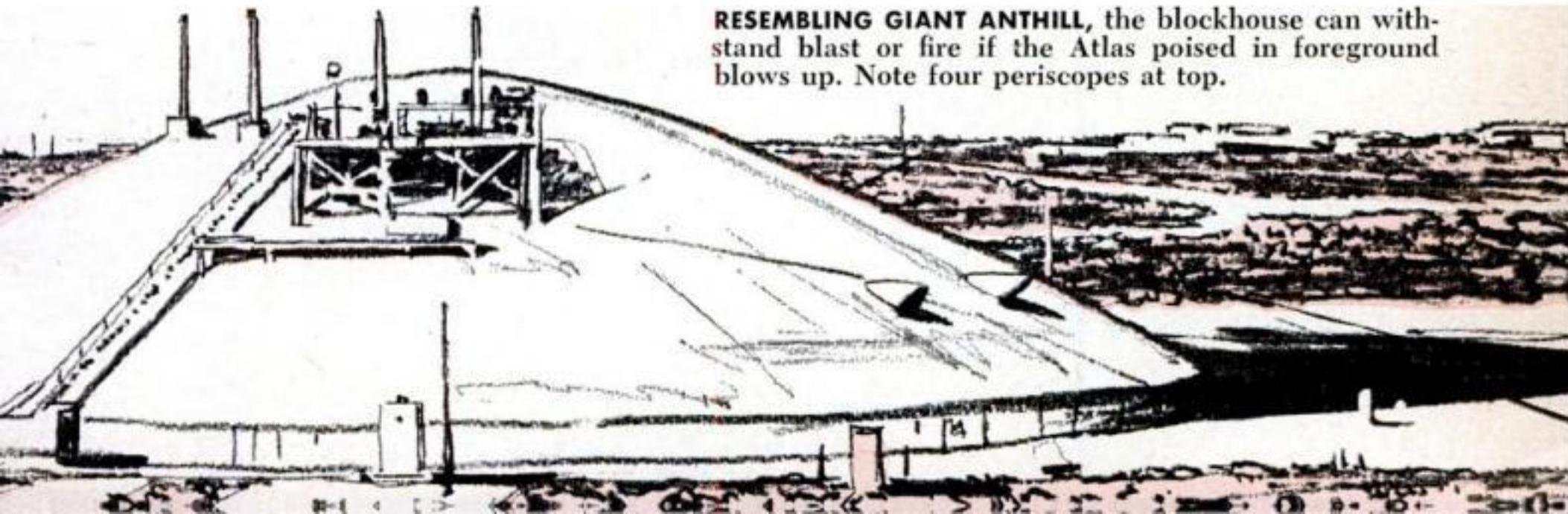
Atlas Blockhouse  
Cape Canaveral, Fla.

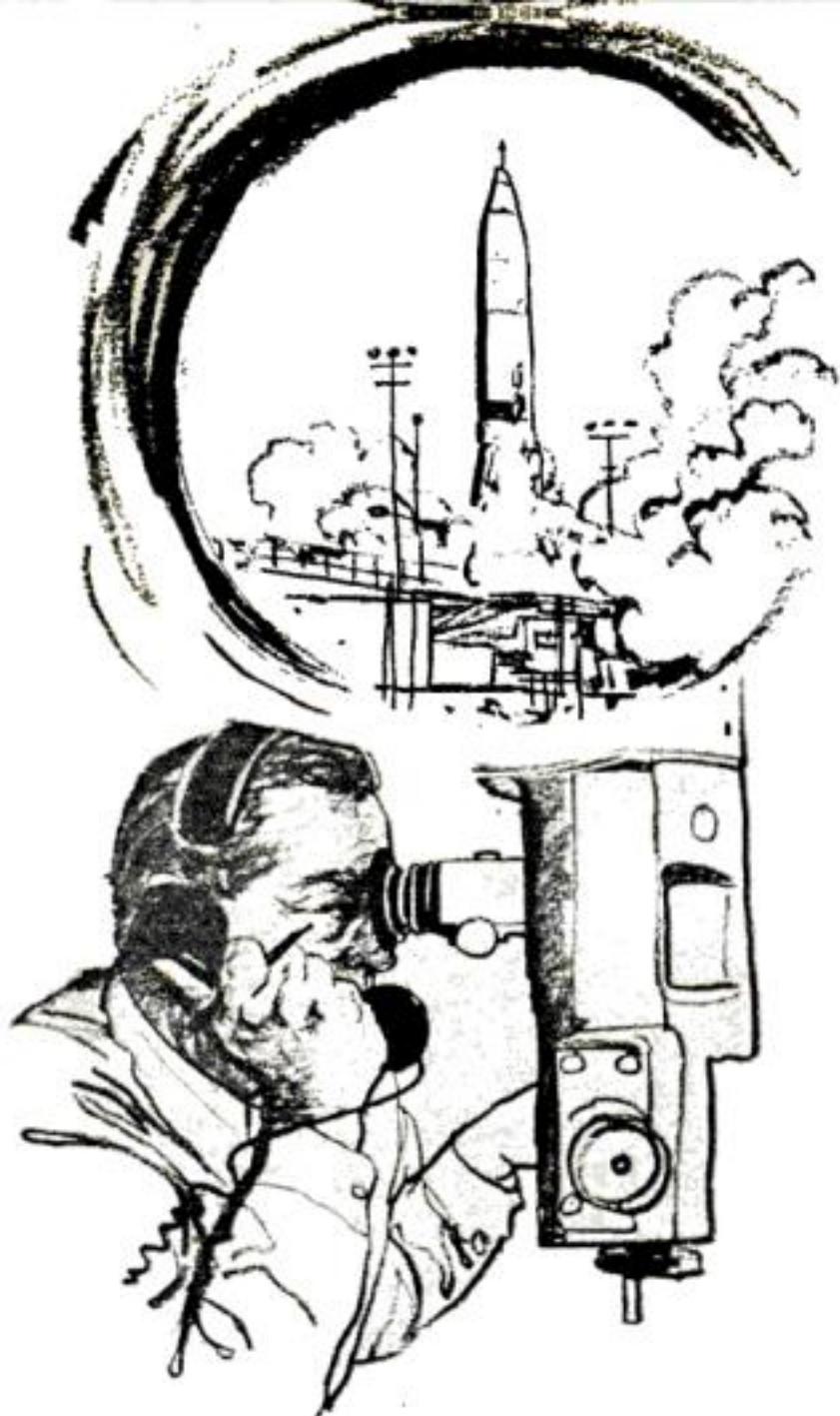
**COUNTDOWN** readies the mighty Atlas for trial. Crew of 50 in blockhouse view the missile on TV screens, top, and through periscopes as at upper right.

gest of the fortresses look like gigantic anthills—huge windowless cones of sand-covered concrete, some 160 feet in diameter at the base. Atop them, rows of periscopes lift metal flaps like eyelids, and peer out upon sand and sea.

What mysterious purpose these installations serve would tantalize a pre-Space Age military-intelligence officer. Could they be, he might ask himself, for some futuristic form of coast defense? The truth is stranger; they are for defense

**RESEMBLING GIANT ANTHILL**, the blockhouse can withstand blast or fire if the Atlas poised in foreground blows up. Note four periscopes at top.





**PERISCOPE** gives an observer in blockhouse a direct view of Atlas on pad, 750 feet away. What he sees is shown in upper part of sketch.

against no invading enemy, but from our own weapons.

These are the blockhouses from which, by remote control, they launch early trial versions of our great ballistic missiles and satellite-bearing space vehicles. Anything can happen in the perilous initial tests of giant rockets, crammed with explosive fuels and searing acids. And that explains these massive bunkers.

At its Cape Canaveral launching site, the Air Force Missile Test Center conducts trials for all the armed services. The destructive might of each type of missile, should it explode on the launching pad, is reflected in the size and sturdiness of its blockhouse. The smaller ones fire Vanguard, Thor, Jupiter; the great anthills-with-periscopes, the Atlas intercontinental ballistic missile.

**Beyond access and view** of sightseers, the blockhouses lie far within the strictly guarded 14,500-acre launching area. Newspapermen get no nearer than a mile away, when they are admitted to an improvised press grandstand to watch a missile launching. Recently, however, the De-

fense Department permitted POPULAR SCIENCE's reporter and artist to inspect one of the Cape's Atlas blockhouses, inside and out—and learn what happens there while distant watchers are awaiting the spectacular sight of an Atlas blasting off.

A black, white and silver Atlas, due to be fired within the next few days, already stands cradled in its 12-story-high servicing gantry at Pad No. 12, where an Air Force bus drops you off. It towers more than 80 feet high, and looks to be at least 12 feet in diameter. You've seen the Atlas in pictures before but only now, standing near it, do you realize how big it is. The "pad" it rests upon is a steel-and-concrete launching platform, at the end of an inclined ramp. This is one of four Atlas launching sites, each with its own blockhouse, at the Cape.

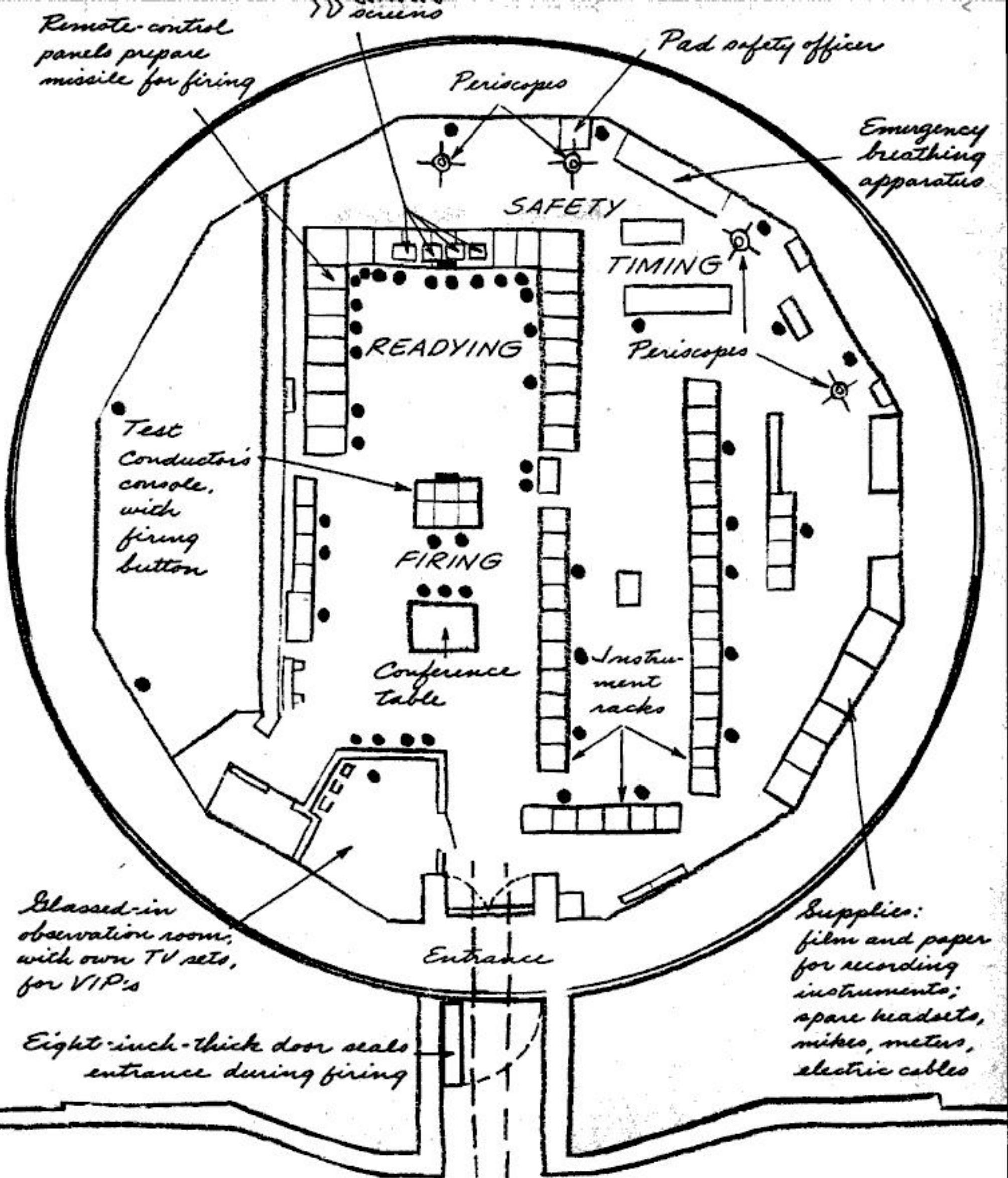
**The great low blockhouse**, its sandy, light tan coat like the Cape sand underfoot, stands less than 10 missile-lengths away. Its walls are six to 10 feet thick, and its dome of steel-reinforced concrete is topped by a 10-foot layer of sand. Designed to withstand the explosion of 50,000 pounds of TNT 50 feet away, it offers protection against blast, fire, flying wreckage—anything but a direct hit by the Atlas itself. A tunnel-like entrance leads you to the single doorway, closed and sealed at firing time by a steel door eight inches thick, and you enter the blockhouse's interior.

You find yourself in a circular room 115 feet across, illuminated by ribbonlike panels of light along the ceiling. Gazing at its panoply of electronic consoles, instrument dials, and twinkling indicator lights, you could imagine yourself in the control cabin of a spaceship of the future.

**On four television screens** at the front of the great room, you see the very scene you have just left—the Atlas and its gantry, at the launching pad 750 feet away. The screens show the missile from four viewpoints, 90 degrees apart. At will, each image can be varied from a distant view to a close-up one.

Four periscopes, along the wall at the front and to the right, enable observers to view the missile directly. The periscopes' shafts disappear into the room's ceiling, to rise like masts above the top of the blockhouse.

Clock faces, just below the TV screens, guide a countdown's timing. One dial



**CIRCULAR ROOM** in blockhouse, 115 feet across, contains remote-control equipment, as shown,

for launching Atlas. Black dots indicate stations of men who operate maze of apparatus.

shows standard time. A second one registers time elapsed from the beginning of a countdown. A third and fourth show total and individual duration of "holds," the unscheduled interruptions of the countdown to remedy any difficulties that may arise. At a number of key points in

the room, there also are digital counters whose glowing red numerals show the remaining minutes and seconds to firing time.

A blockhouse crew of 50 technicians mans this array of equipment for an Atlas launching. Over them presides the test



**MANNING STATIONS** in blockhouse, technicians check on some 4,000 items during countdown.

conductor, a civilian from the Convair company that makes the Atlas, who sits with his assistant at a central console. Any visiting VIPs get shooed into a glassed-in observation booth at the rear, complete with its own TV sets, where they'll be out of the way. Nobody else, but nobody, gets in during a launching.

That's the setting for the countdown that precedes an Atlas firing—a meticulous checkout of missile components and launching facilities for readiness, comprising as many as 4,000 items and taking four hours or more to complete.

Of course that doesn't mean it would take hours to fire an Atlas, when it's in service. The thing to remember is that this isn't an "operational" firing at all, but a proving-ground trial.

Tracking cameras, radar installations, telemetering stations, successively springing into action at the Cape and all along the ocean firing range, will gather an immense variety of performance data. When such trials have perfected the Atlas, perhaps by next year's end, the Cape will be through with it. Then it will go to operational ICBM bases at Cheyenne, Wyo., and other U.S. sites still to be announced.

**Launching activity at the pad** begins well before the countdown. Within the blockhouse, circuits are tested, needed

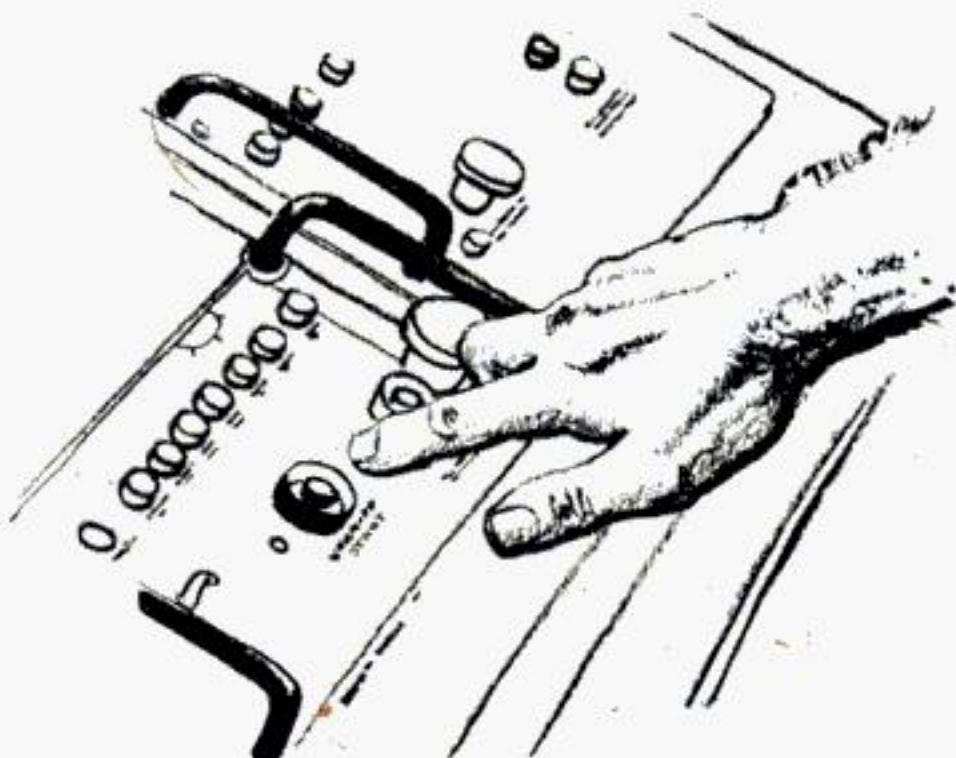
supplies assembled and checked. Emergency oxygen apparatus is made ready. If a missile catastrophe should envelop the blockhouse in flames or noxious fumes, this equipment will provide a 30-to-40-minute air supply to breathe.

Usually between three a.m. and seven a.m., the countdown starts. Out at the pad, which for some time is the center of activity, steel-helmeted missilemen load the Atlas with fuel. They install an explosive "destruct" charge to enable the missile to be blown up by radio control, if it should fly erratically and become a menace. Signal lights, at the pad and at the blockhouse's entrance, change from green to amber as the Atlas becomes "hot" or dangerous.

**Overhead, two planes roar out to sea.** By radar, one searches the danger zone for ships; the other monitors the ether for radio interference in the channels to be used in the Atlas trial.

Its work done, the 125-foot-high, red-and-white gantry ponderously rolls away from the pad, leaving the Atlas poised for flight—the angle-of-attack indicator at its nose suggesting a spear about to stab the sky. The signal lights change from amber to red—clear the pad, take cover. Behind the last man into the blockhouse, the steel door clangs shut.

Now all are at their stations in the blockhouse's great circular room, at panels with such labels as ENGINE TEST, TELEMETER, MISSILE POWER, LOX TANKING INTERIM. At "T minus 35"—35 minutes to firing—ultra-hazardous liquid oxygen is pumped into



**THIS BLACK BUTTON** fires Atlas. Button and knob beside it can stop engines and the launching.

the Atlas lox tank by remote control. Instruments check the missile's weight, the level of lox, the tanks' pressure. With 10 minutes to go, the blockhouse counter begins calling off each passing minute.

"**T minus two**"—and the blockhouse's ventilating blowers whine to a stop, as intakes are sealed for safety. Things are happening fast now. Missile circuits are switched from outside power to the Atlas' own. A gyro is uncaged. Panel operators, queried in turn by the test conductor over the intercom, confirm completion of final steps.

At Central Control, the firing range's nerve center in a green-tinted building three miles away, the planes' reports are in: no ships in the way, no radio interference. Downrange observing stations are alerted and ready. Clearance to fire passes from Central Control to the blockhouse.

A dozen indicator lights glow green on the console of the man who fires Atlas—all is ready. The time is T minus 30 seconds. . . 25. . . 20. . . The test conductor presses a little black button marked **VERNIER START**.

That does it. "Automatic sequencing" takes over. Cameras begin whirring, oscilloscopes recording. At T minus five seconds, flame spurts from vernier rockets on the Atlas' sides—two small auxiliary engines that help to stabilize flight and control final speed. A Niagara of cooling water, 30,000 gallons a minute of it, cascades down the flame deflector beneath the Atlas.

#### T MINUS ZERO!

Even within the sealed and massive blockhouse, the crew hear the thunder and feel the floor quiver, as the Atlas' main engines erupt an inferno of fire. They turn the cooling water to billowing clouds of steam, rising and enveloping the Atlas. For 10 seconds the great missile strains against rugged hold-down arms—an innovation pioneered by Atlas—as it builds up thrust.

Up to that last moment, the launching could still be halted, if something should go haywire and one of the tense instrument watchers should call out "Cutoff!" Just to the right of his black firing button, the test conductor has a similar red one, marked **VERNIER CUTOFF**. Pressed before the main engines start, it will override the sequencer and stop the

launching. If it's too late for that, the test conductor would smack an adjoining red knob labeled **MAIN ENGINE CUT-OFF**.

But this time, there's no hitch and the red controls go untouched. At T plus 10 seconds, the hold-down arms spring away from the captive Atlas and free it.

**Slowly and majestically** at first, then with mounting velocity, the thundering Atlas rides its twin blowtorch columns skyward. Its shrinking image vanishes from the blockhouse's TV screens, whose tilting cameras have followed it upward. The blockhouse's launching task is done.

The fate of the speeding Atlas hangs now upon the Range Safety Officer at Central Control, where tracking equipment is charting the missile's course with



"**T MINUS ZERO**" brings jolt, muffled thunder, as Atlas' main rocket engines come to life.

incredible speed and accuracy. If its path wanders beyond predetermined safety limits, he must press a button that destroys the \$2,000,000 missile in mid-flight. That has happened; but there have also been more successful shoots, of trial Atlas missiles that escaped his intervention.

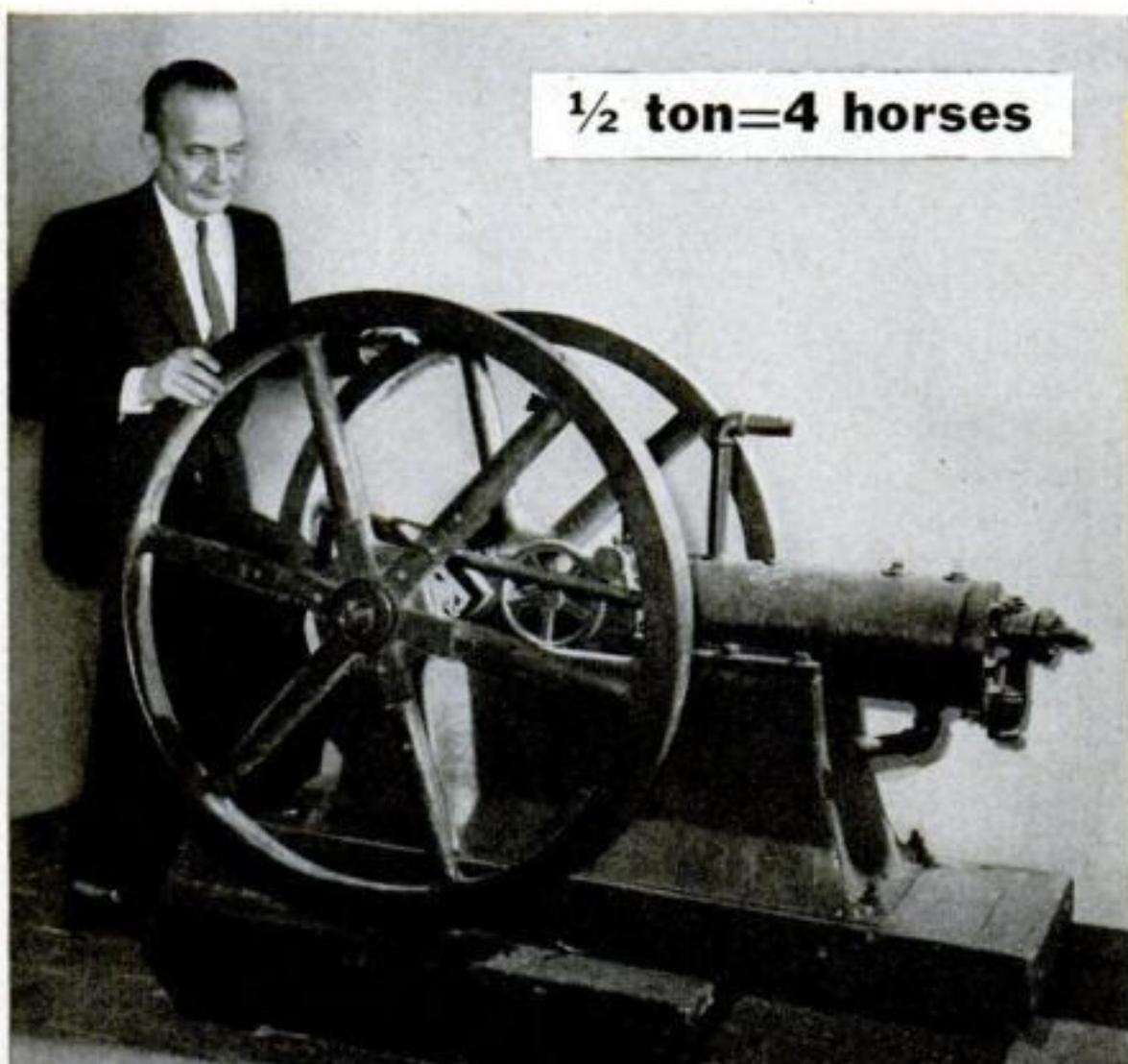
And from each of the Atlases that have completed their flights, priceless stacks of recovered data are speeding the day when our ICBMs will be perfected.

So it can be said that, by fulfilling their hazardous task of launching these trial missiles, the men in the Cape Canaveral fortifications are helping to fortify the whole nation.

END

# The Wonderful One-Lung Engine

**Once an oversized weakling, it's now an eager beaver doing hundreds of jobs and ready for more**



**BORN BIG**, the one-cylinder gas engine developed mightier muscles while growing smaller. At left, Fred Lauson stands beside his father's first engine, half a ton of ironmongery that developed four horsepower. It has a bore and stroke of  $4\frac{3}{4}$  inches, two 42-inch flywheels, and is almost six feet long. Compare it with the potent little power package at right, a two-cycle engine made to run a chain saw. It weighs less than 14 pounds and is rated at  $5\frac{1}{2}$  eager-to-work horsepower.

**By Harry Walton**

WHEN Grandpa was a boy, one horsepower was best defined as 1,500 pounds of tractable beast. The other day I held in one hand a  $13\frac{3}{4}$ -pound engine made to run a chain saw. It turns up  $5\frac{1}{2}$  horsepower and sounds like an angry caucus of the horseflies that the gas engine is driving out of existence.

Little engines are big business. John Homeowner bought 3,300,000 last year on power mowers alone. Over 400,000 are slated to go on chain saws this year. Total engine production for 1958 is expected to be four to five million.

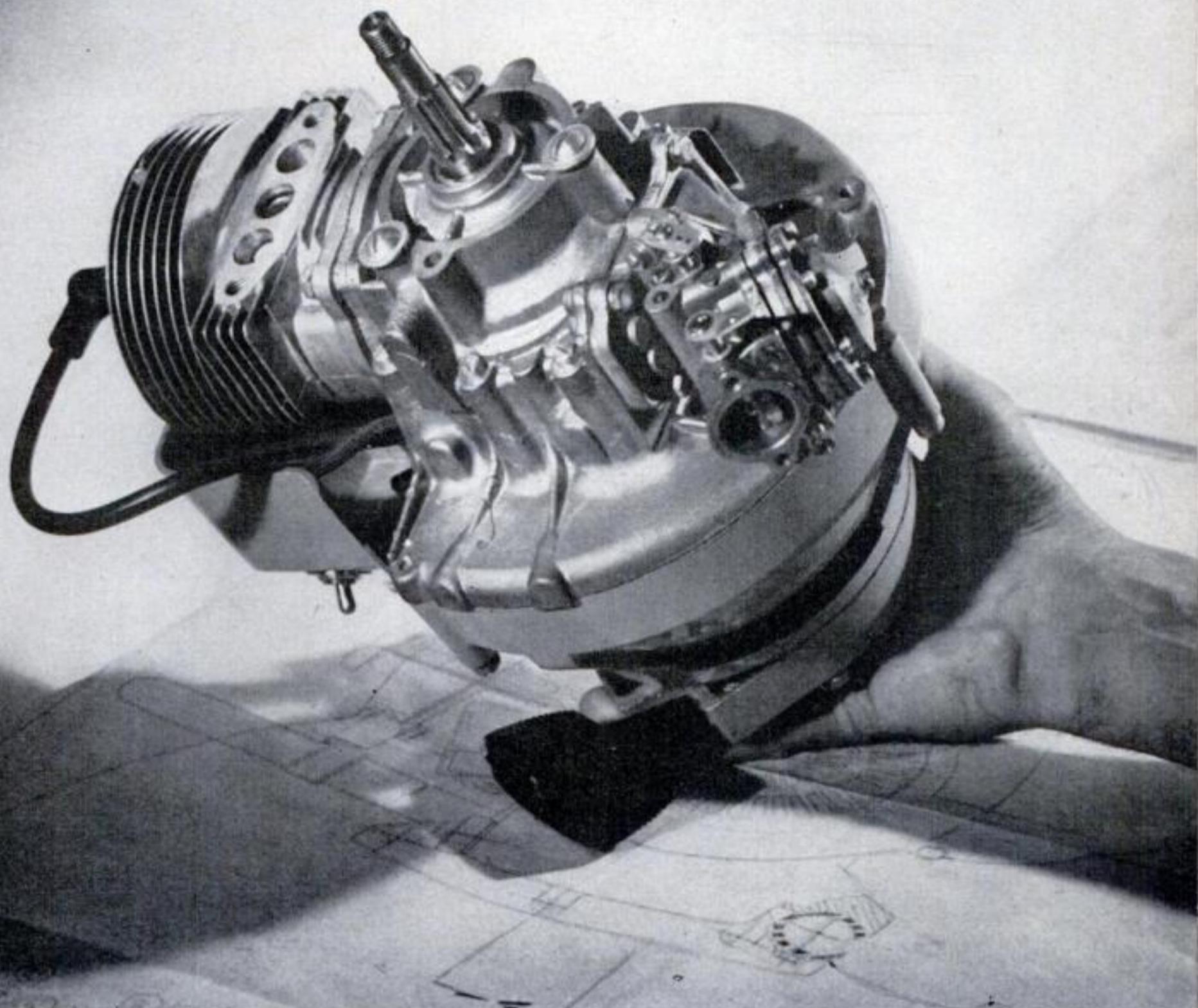
What jobs will this 10,000,000-odd horsepower do? How did these little engines develop and what will they be like

tomorrow? To get the answers I talked to the engine manufacturers and nudged memories going back to the turn of the century.

**They do everything.** One maker has logged 300 engine-using implements. One-lungers unload coal and grain, clear off snow, shear sheep, mix feed, shell corn, spread sand and fertilizer, and crush ice. They mark highway lines, trim hedges, spray fluids, drive pipe into the ground, pump mud, saw ice and cut up whales.

In New York state, an engine-driven vacuum picker sucks fruit off the tree. Georgia pecan farmers use engines to harvest fallen nuts. Augers driven by one-lungers tap maple trees. One man even powered roller skates with a lightweight engine on his back.

## One handful=5½ horses



**They go where the work is.** Besides manicuring suburban lawns, many engines stand by to furnish emergency electricity to rural homes. Floods and other disasters always bring rush orders, manufacturers say, for engines to drive portable generators, water pumps and chain saws.

You'll find these piston-packing little power plants heating and lighting polar camps, airports and weather stations. Under canvas shrouds, they pump heat into cold plane engines. One-lungers nestle against giant engines on road-building machines—their effective little bark nudges the huge diesels into action.

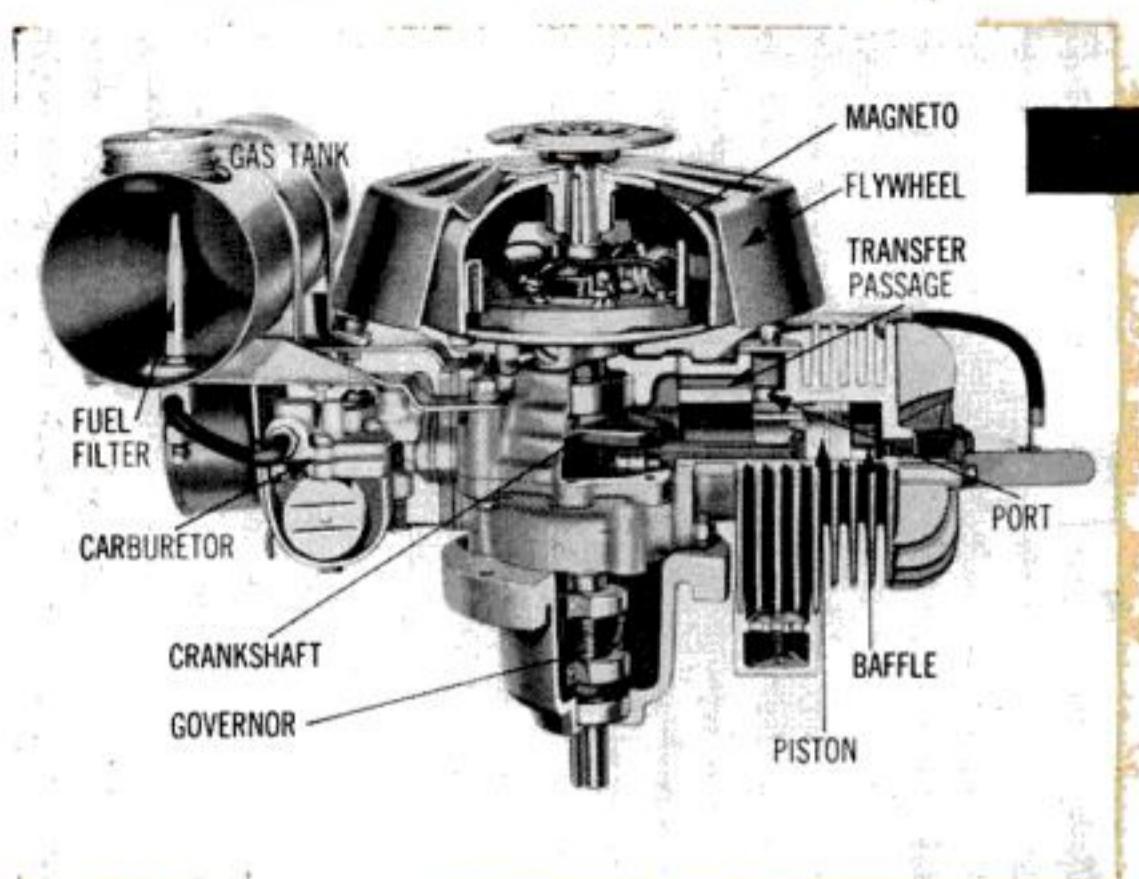
Engine-powered smoke generators lay a protective cover to keep frost off crops. Small electric plants furnish juice for saws, drills and hammers to put up any-

thing from a log cabin to a subdivision before the power lines arrive. Little engines mix concrete, drill rocks for blasting, smooth welded joints. They take to the highway in trucks to refrigerate produce. On scooters and three-wheelers, one-lungers haul around golfers, industrial and airport workers, commuters, mailmen, cops, and just-for-fun riders.

**What's in the future?** Having a good thing, engine manufacturers want to make it better. Musts on the docket are silencing and starting. Present one-lungers are much too noisy. Research on mufflers, insulation and sealed housings will let you enjoy that late Sunday snooze even if lawn-mowing neighbors are early birds.

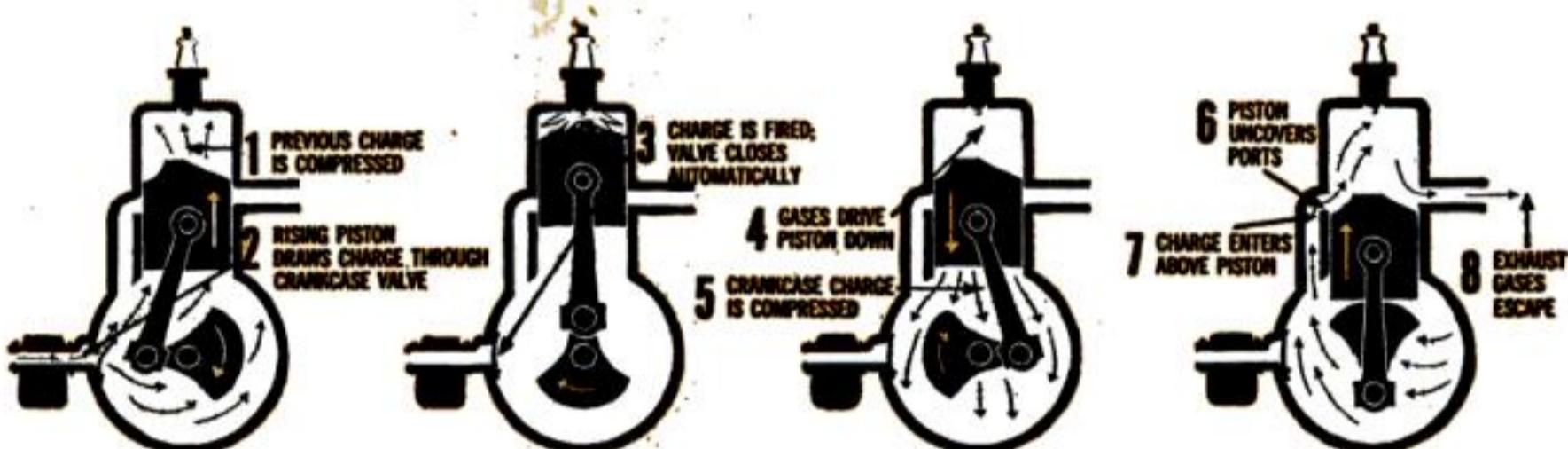
Electric starters are here; they range from an induction motor mounted right

## The modern lightweights can fire every time around



### TWO-CYCLE

**FIRING** once per revolution, a two-cycle engine draws the fuel-air mix into its crankcase. The diagrams below show a two-port engine. A spring valve in the crankcase wall lets each fresh charge enter, then snaps shut. A three-port engine has an intake port in the cylinder wall, uncovered by the piston skirt near top dead center, through which the charge enters.



on the blade shaft to more elaborate 115-volt rigs and battery-starter-generator deals. Still wanted is a cheap, lightweight one you could use without trundling to a power outlet or lugging a heavy battery.

Clinton gets there on another tack with its impulse starter, a spring-wind rig which, when you press the button, spins the engine for 17 turns at twice the speed you could with a rope. Also popping is the idea of using compressed carbon dioxide to give an engine that starting twist. Once here, easy starting may make woman's work of lawn mowing.

Another surprise in Clinton's bag of tricks is supercharging to further boost power. In test engines already running, the same blower that cools the block feeds pressurized air to the intake.

Lauson lines aluminum blocks with cast-iron sleeves. Briggs and Stratton lightweights have chrome-flashed pistons running directly in aluminum bores. Clinton engines will soon have light, long-

lived blocks cast of a nickel-chrome alloy requiring no liner.

The flywheel magneto will probably see no great changes. But there is a hushed whisper about an exciting new ignition system without magneto, points or even wiring. It has a chemical crystal, big brother to those in phonograph pickups, that shoots sparking voltage across a plug when squeezed by a push rod.

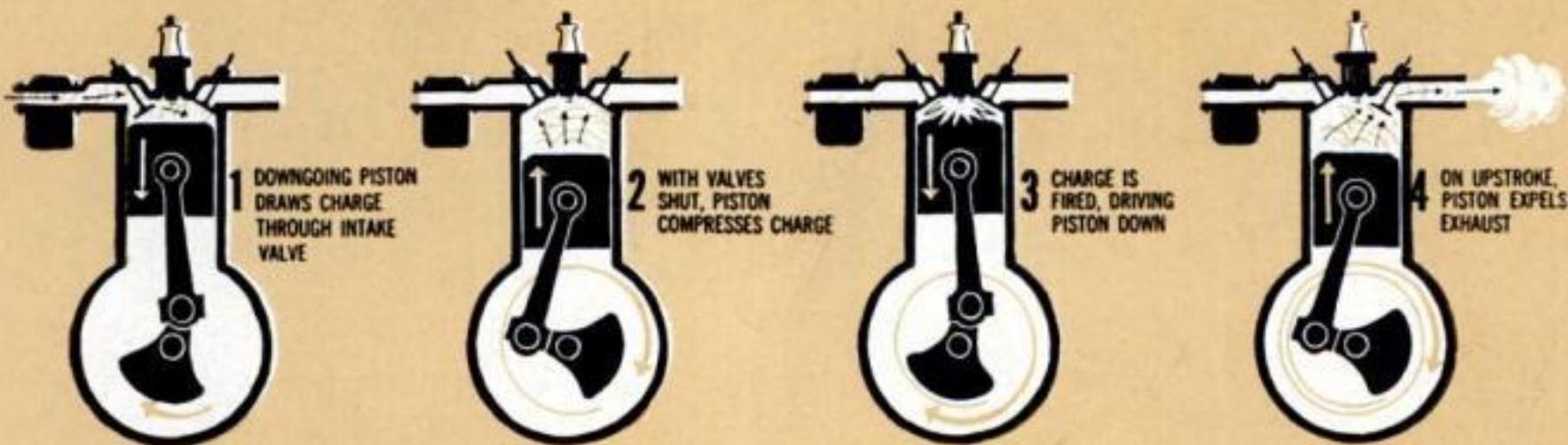
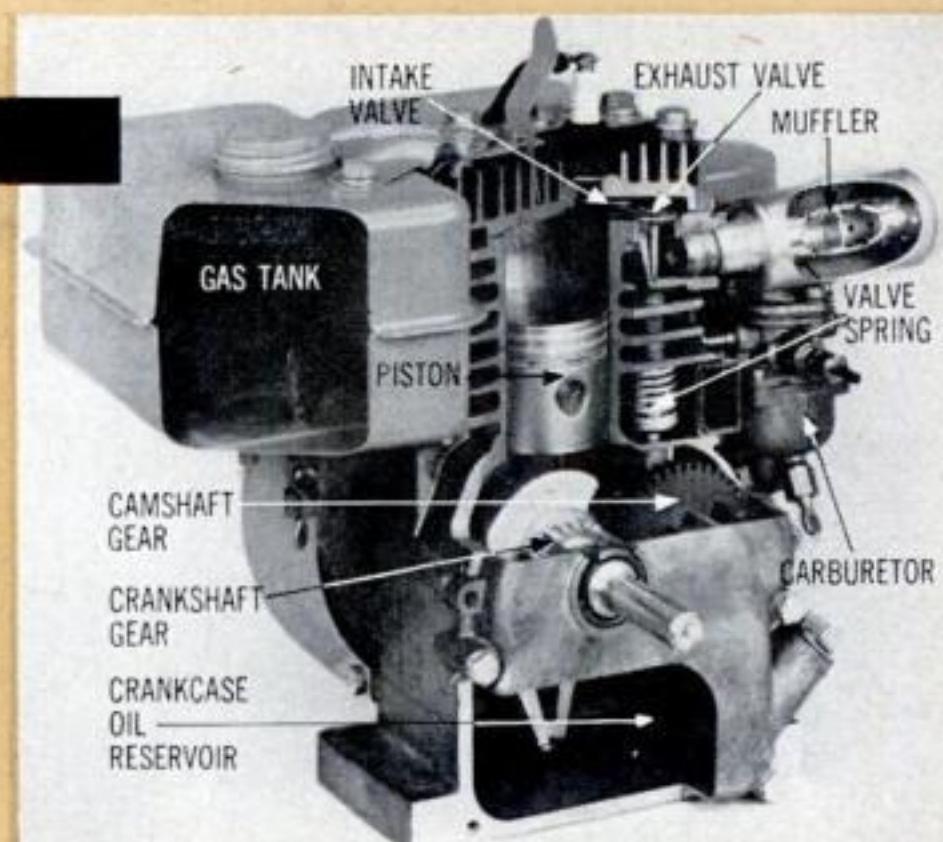
Buyers will be wooed by new styling, lower lines, attractive jacketing. On some engines you can't find anything so crass as a bare cylinder even now. Color will be used as freely as on fishing lures.

**Controls** may be simplified to one handle-high knob for choking, throttling and stopping. Extra uses may be added. One maker plans an engine-driven vacuum cleaner for housekeeping around patios and garages. Toward easier servicing, one mower already has a hollow handle through which you fill the gas tank without stooping.

# The L-head one-lunger works like your auto engine

## FOUR-CYCLE

WORKHORSE of the small-engine stable is the four-cycle L-head engine. As shown in the drawings below, it fires only once every two revolutions. Valves (opened by cams on a shaft geared in a 1:2 ratio to the crankshaft) may be to one side as in the cutaway view at right, on both sides, or in the head as in drawings below. Most modern car engines are of the valve-in-head type.



Even the mildly messy job of mixing gas and oil for two-cycle machines may be done away with. Clinton plans separate tanks for gas and oil, mixing these through a metering valve. You'll also be able to buy ready-mixed fuel in cans and, if you buy a mower from one mail-order house, get a year's supply free with it.

That ritzy cousin of the utility one-lunger, the outboard, today wears sports clothes to go down to the sea in craft ranging from canoes to houseboats. But these two divergent types were close linked in the development of the breed.

A lighter, safer power source than the steam engine was badly needed in the late 19th century. The automobile was struggling to be born. Bikes were the rage but pedaling wasn't; many a mechanic dreamed of iron muscles on his wheel.

The first glimmer of an explosion engine dates back to the idea of using gunpowder as fuel in 1680. In 1826, an Englishman powered a carriage, a boat and

later four water pumps, with explosion engines. By 1860 a primitive engine that sucked in air and oil vapor and fired it midway of the intake stroke was in use.

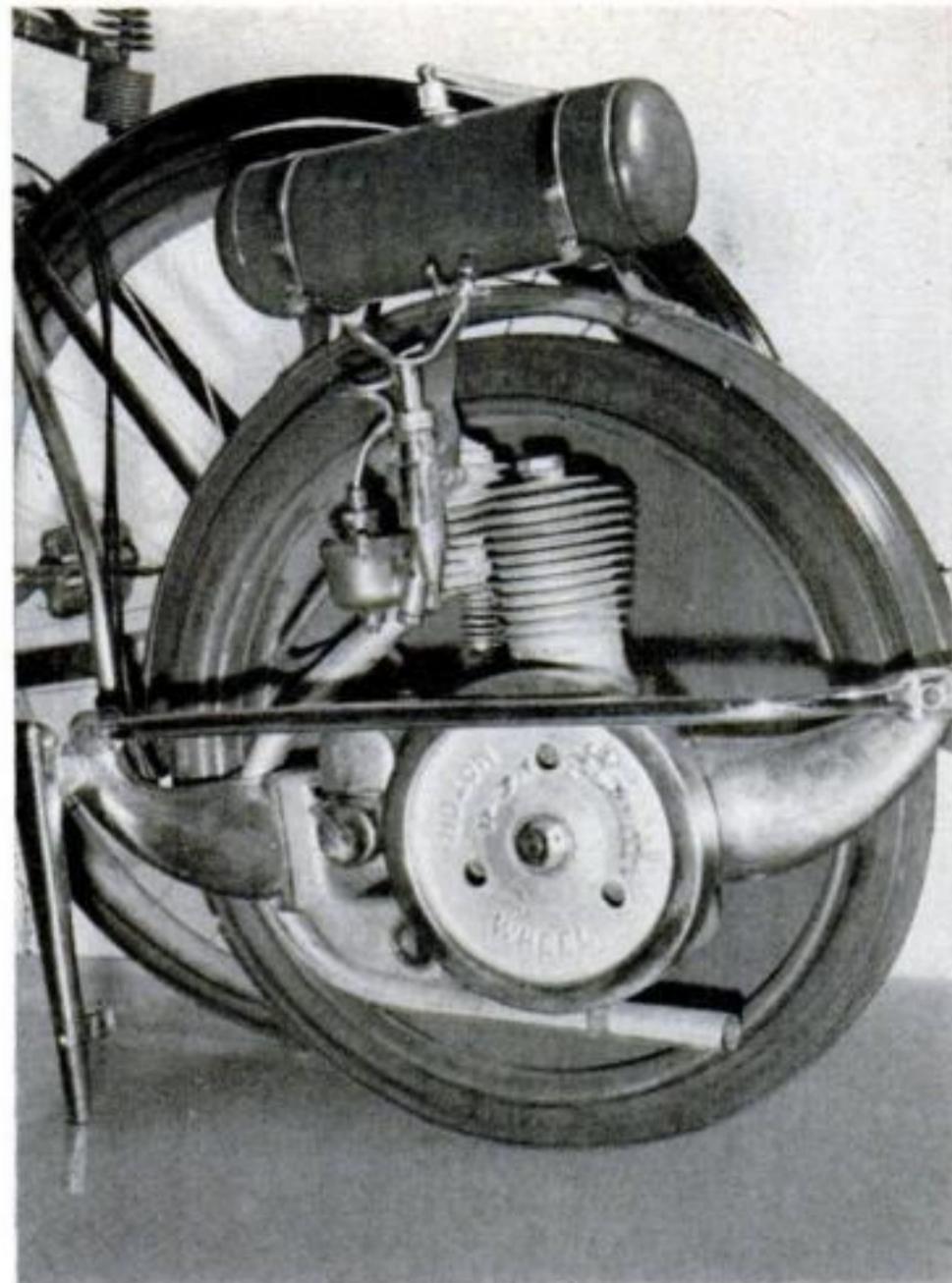
**The need for compression** was discussed as early as 1799, but not until 1862 did Beau de Rochas patent his four-cycle principle. In 1876 Nikolas Otto built the first successful engine of that type. Ten years later Gottfried Daimler hitched a petrol engine to a bicycle—and so fathomed the automobile.

This marked the beginning of the lightweight, high-speed gas engine. Those before Daimler's weighed up to half a ton per horsepower and slogged over at about 200 r.p.m. His weighed 88 pounds per horse, hit 800 r.p.m. The one-lunger was coming of age by growing smaller.

**Two explosions for one** were the goal of inventors discontented with the four-cycle engine, which yields only one power stroke every two revolutions. An Englishman named Day in 1891 built the first

## **Wheeled engine powered bikes and buckboard cars**

**THE SMITH MOTOR WHEEL** with its four-cycle engine, designed in 1912 to drive a bike, was adapted to the Smith Flyer, a down-to-earth sports car with a hardwood frame. It could do 22 m.p.h., climb a 15-percent grade. Drive was engaged by lowering the hinged motor wheel to the road.



engine to take in the fuel charge through the crankcase and fire every time around. But the first two-cycle engine in this country was probably a marine one-lunger made at Cos Cob, Conn., in 1895.

Like the reed-valve two-cycler you may have on your mower, this was a two-port design taking in gas and air through a crankcase valve. The incoming air dragged along a spray of gas from a carburetor about as sophisticated as a Flit gun (it was made from a plumbing valve). But the ignition system inventor Ray Palmer devised was charmingly ingenious. It permitted the engine to be reversed on the fly, and it kept on firing even if doused with water—two enormous virtues in a seagoing power plant.

**How to set off an explosion** inside a cylinder—and do it from 100 to 2,000 times a minute—was a problem that sparked some weird solutions. When you yank the cord on a modern engine, a flywheel magnet induces current in a coil of wire. The points snap open at just the right instant, and a spark jumps the plug.

But the first engines predated such electrical know-how. An early ignition system had a port in the cylinder wall

with a flame burning outside it. (One such "igniting cock" was used until 1892.)

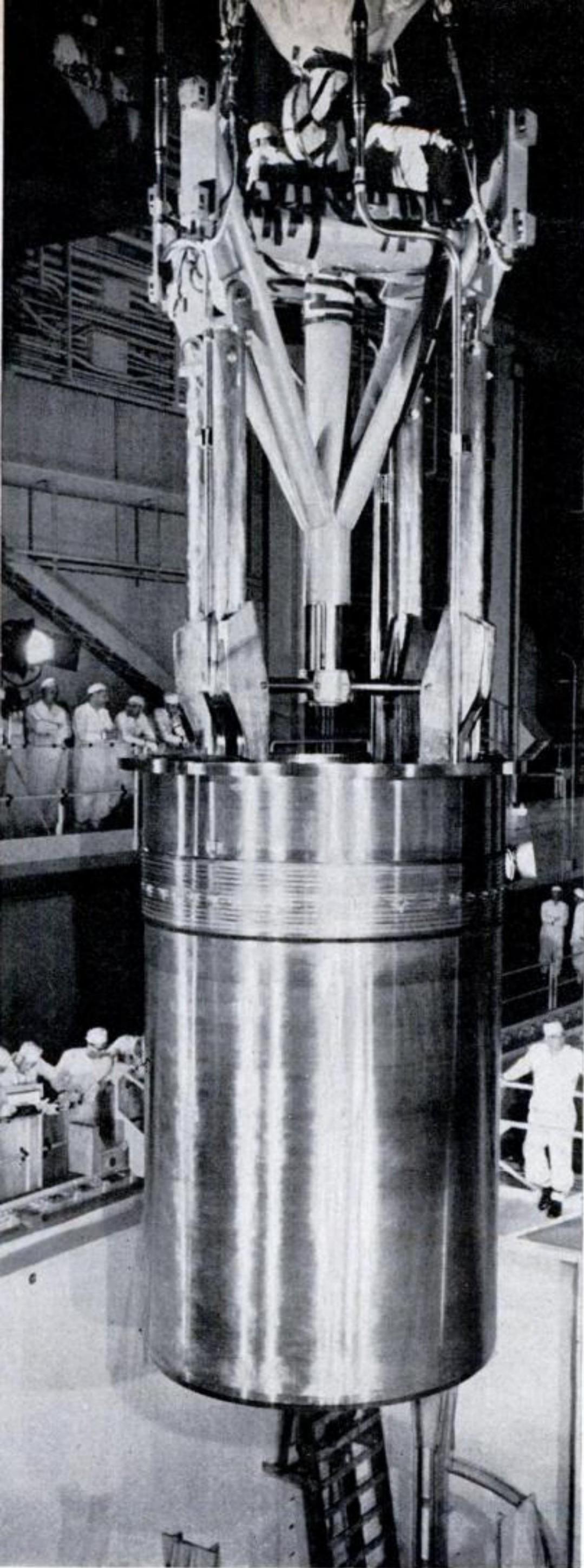
An open port became impractical once compression was introduced. Instead, a metal tube, closed at the outer end, was screwed part way into the cylinder head. An external flame kept the tube hot. As the charge was rammed back into the red-hot tube, the fuel exploded.

Palmer's electric "igniter" was fired by dry cells. The coil had a single winding (the one in your car has two). The points were inside the cylinder. One, called the flipper, was mounted on a shaft in a mica bushing. A crankshaft eccentric (which also worked the water pump) momentarily kicked the flipper against the end of a grounded nickel-silver screw. This brief make-and-break induced a voltage surge in the coil, and a spark jumped across the points as they opened.

"Six big dry cells would last two or three seasons," recalls Henry Zerbarini of the Palmer Engine Company. "And if a tripper spring broke, a fellow could make port with a hairpin."

By adjusting the tripper timing, you

**[Continued on page 216]**



# The Big 'Ifs' of Atomic Power

***The world's first nuclear power station is turning out enough juice to serve a sizable city—but they are costly kilowatts***

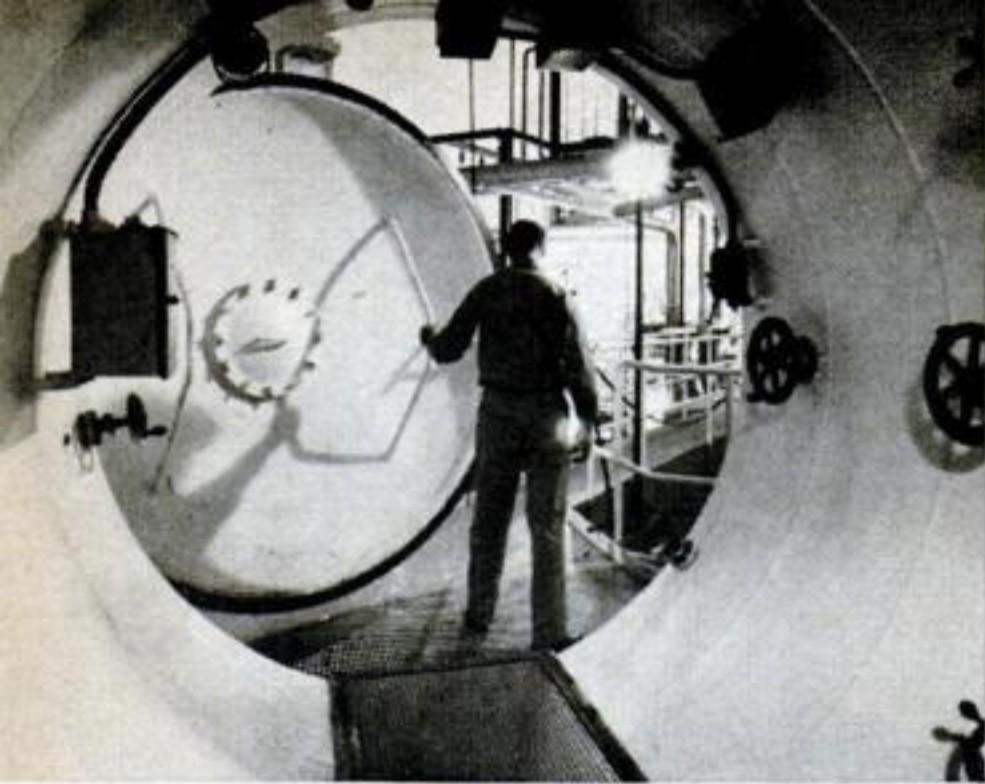
**By Harland Manchester**

ON A 435-acre tract on the Ohio River near Shippingport, Pa., stands a major triumph of the Western World—America's first full-scale nuclear power plant. There, only 15 years after the first chain reaction in the historic Chicago squash court, atoms silently splitting in a smokeless, dustless concrete cavern are making electric power enough to serve a city of 85,000.

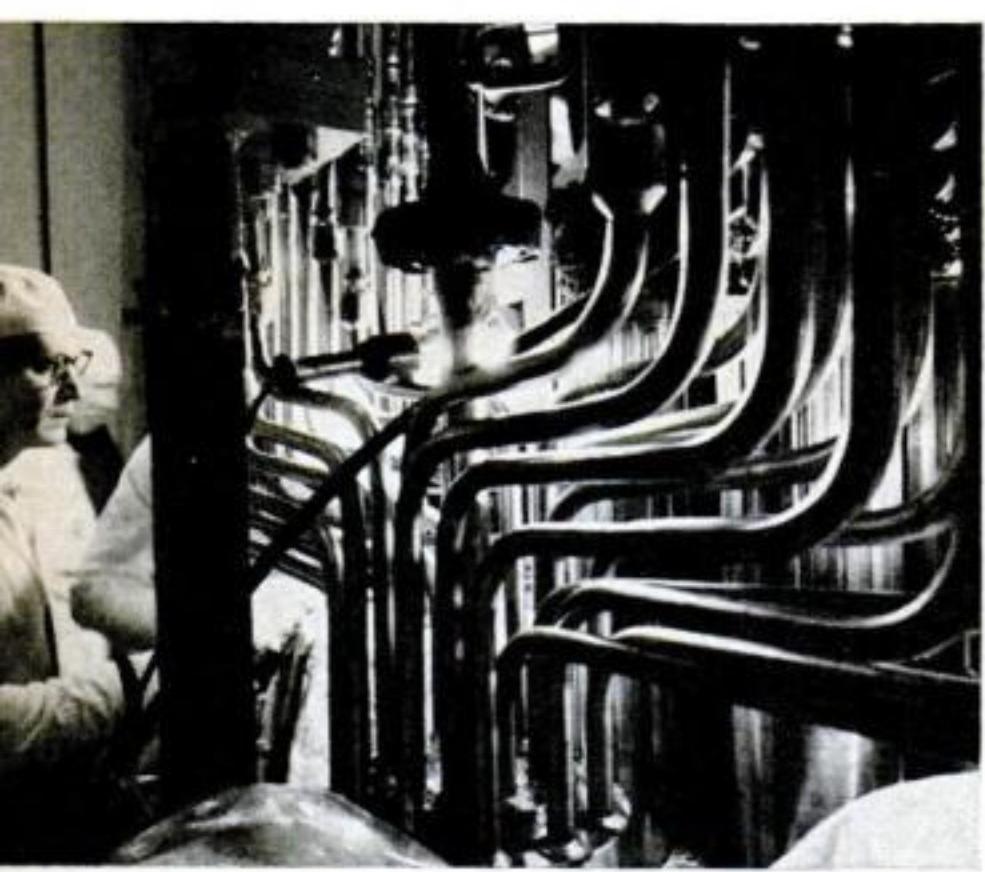
The Shippingport plant, built largely by the Atomic Energy Commission, is operated under contract by the Duquesne Light Company.

Meanwhile, some 35 miles southeast, at Elrama, Pa., Duquesne is adding a new unit to one of the plants in its system. For about one-fourth the building and research cost of Shippingport, this plant—a conventional coal-fired one—will turn out nearly three times as many kilowatts, using fuel that will cost less than one-

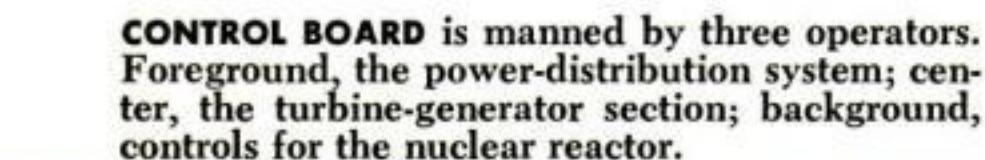
.....  
**HEART OF AN A-POWER PLANT:** 58-ton core—the nuclear-fuel charge—is eased down into position at Shippingport, Pa., generating station. Fission process takes place within this core.



**DOORWAY TO UNLIMITED POWER** for tomorrow? Giant porthole leads to chamber containing 100,000 feet of pipe needed to transfer energy from chain reaction to turbine generator.



**LIKE A SURGEON BEFORE AN OPERATION**, technician makes a final instrument check. This apparatus atop the reactor feeds information to control room where it is automatically recorded.



**CONTROL BOARD** is manned by three operators. Foreground, the power-distribution system; center, the turbine-generator section; background, controls for the nuclear reactor.



twentieth as much as that of its atomic partner.

This cost comparison reveals one of a large herd of sharp-horned dilemmas which beset the nuclear pioneers in their high-hearted trek toward the promised land of atomic plenty. Atomic plants are costing far more than the first estimates, and this has had a sobering effect on private power companies. Whereas Shippingport was expected to cost around 50 million dollars, the final tab was \$121,400,000 (nearly 100 million dollars from the taxpayers); and other big atomic plants now under construction have burst through their estimates by many millions.

"As long ahead as we now plan," says John E. Gray, Duquesne's general superintendent of construction, "we will continue to meet increased power demands by building bigger and more efficient coal-burning plants. We start a new one every 21 months, and with coal at \$5 a ton it would be foolish to even think of changing now. Eventually we will learn how to make nuclear power that can compete with rising coal costs, but we have no idea how many years it will take."

"Yet it is not fair to assume that Shippingport is a fair index of nuclear power costs even today. You have to think of it as a tremendous laboratory built to answer questions as much as to make power. Using the experience acquired and following an ordinary schedule, it could be built today much more cheaply. But the cost of its power would still be prohibitive from any practical point of view."

*A tour through Shippingport* helps to show why it turns out gilded kilowatts. Instead of throwing coal on a fire to stoke this plant, they lowered into the reactor a fuel core holding about four million dollars' worth of uranium which had to be packed in a precision-made 15-million-dollar container to make it "burn" right. It holds about 2,500,000 specially tailored bits of uranium packed in about 100,000 wrappers made of an expensive zirconium alloy—a special metal that absorbs few of the neutrons that make the reactor work.

An endless stream of water, held under pressure to keep it from boiling, passes through the reactor, carrying off heat, and continues through a coil where it delivers the heat to a second circuit. Be-

yond that point there is nothing atomic—the water in the second circuit turns to steam and drives a turbine which runs an electric generator.

When the dials in the control room show that some of the fuel is "burned out," the atomic equivalent of shaking the grate takes place. They shut down the plant, flood the reactor with 30 feet of water as a protection against radiation, and pull out the "clinkers" with remote-control tongs.

After an estimated 8,000 hours of operation, the whole fuel charge will be considered "spent." Only a fraction of the vital uranium-235 will have been fissioned, for "poisons" will build up which will slow down the chain reaction. The fuel will be removed to an adjacent concrete tank, where it will cool off for three or four months beneath shielding water. Then it will be shipped in lead casks to an AEC plant in Idaho, where the usable nuclear fuel will be reclaimed and the hot residue disposed of.

**Costly kilowatts.** At present each kilowatt-hour of electricity produced at Shippingport costs 64 mills (6.4 cents), and Duquesne buys it from the AEC for eight mills—about the price of coal-produced electricity in the area. While no one expects that Shippingport will ever pay its keep, the gap should soon be narrowed. Two new plants with the same type of reactor promise to turn out much cheaper power when they open in 1960.

One, a 134,000-kilowatt plant, is being built with private capital on a lake shore near Rowe, Mass., by the Yankee Atomic Electric Company, formed by a dozen New England utility systems. Although the original estimate of 34 million dollars (for plant and fuel) has already gone up to 57 million dollars—more than enough to build two coal plants of the same size—Yankee hopes to make power for 13 mills a kilowatt hour, within possible shooting distance of the nine-mill cost of many plants in the area.

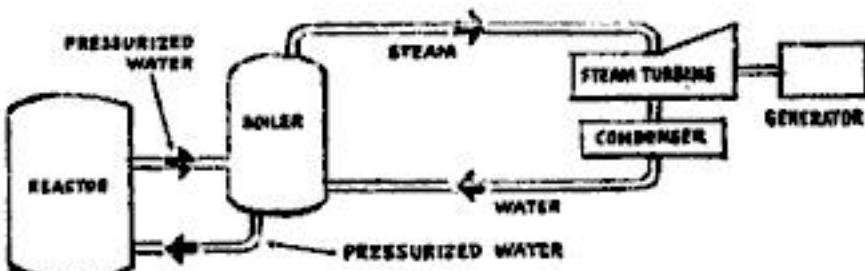
Another big plant being built by Consolidated Edison at Indian Point, north of New York City, is of hybrid design, with 40 percent of the power to come from fuel oil. The major part, however, will come from a nuclear reactor using a novel combination fuel of uranium-235 and thorium. The reactor's neutron bombardment will turn the thorium into fis-

sionable uranium-233, of which some will burn and supplement the heat output. The rest will be reclaimed for possible future use in reactors designed especially for U-233 fuel.

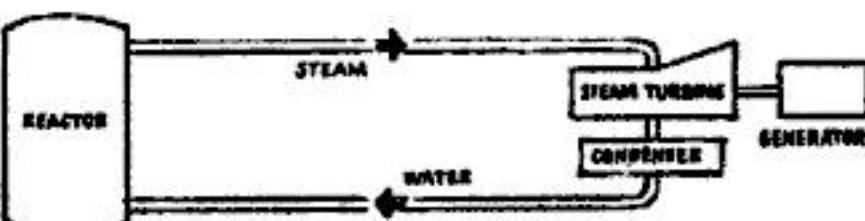
At Dresden Heights, 50 miles southwest of Chicago, a giant steel sphere 190 feet in diameter will soon house an atomic engine which, in the opinion of scientists, has already made white elephants out of Shippingport and its sister plants. This is the "boiling-water reactor" or BWR, based on a hunch credited to the late Enrico Fermi. When the first chain reaction was achieved someone asked how power could be obtained from it. "I'd throw the uranium in a pot of water and let it boil," said Fermi. Years later in Argonne's Idaho Laboratory, engineers brought a water reactor to a boil for a safety test, and found that it worked so well that the idea should be pursued. Since then there have been several generations of experimental BWRs and when the Commonwealth Edison Company of Chicago and seven other companies decided to build the 180,000-kilowatt plant at Dresden, boiling water got the vote.

"This reactor is cheaper to build and more efficient than the Shippingport type," said Joseph Harrer, head of the BWR research project at the Argonne National Laboratory at Lemont, Ill. "We boil water by nuclear fission, make steam and drive the turbine, all in the same pot, instead of using Shippingport's two water

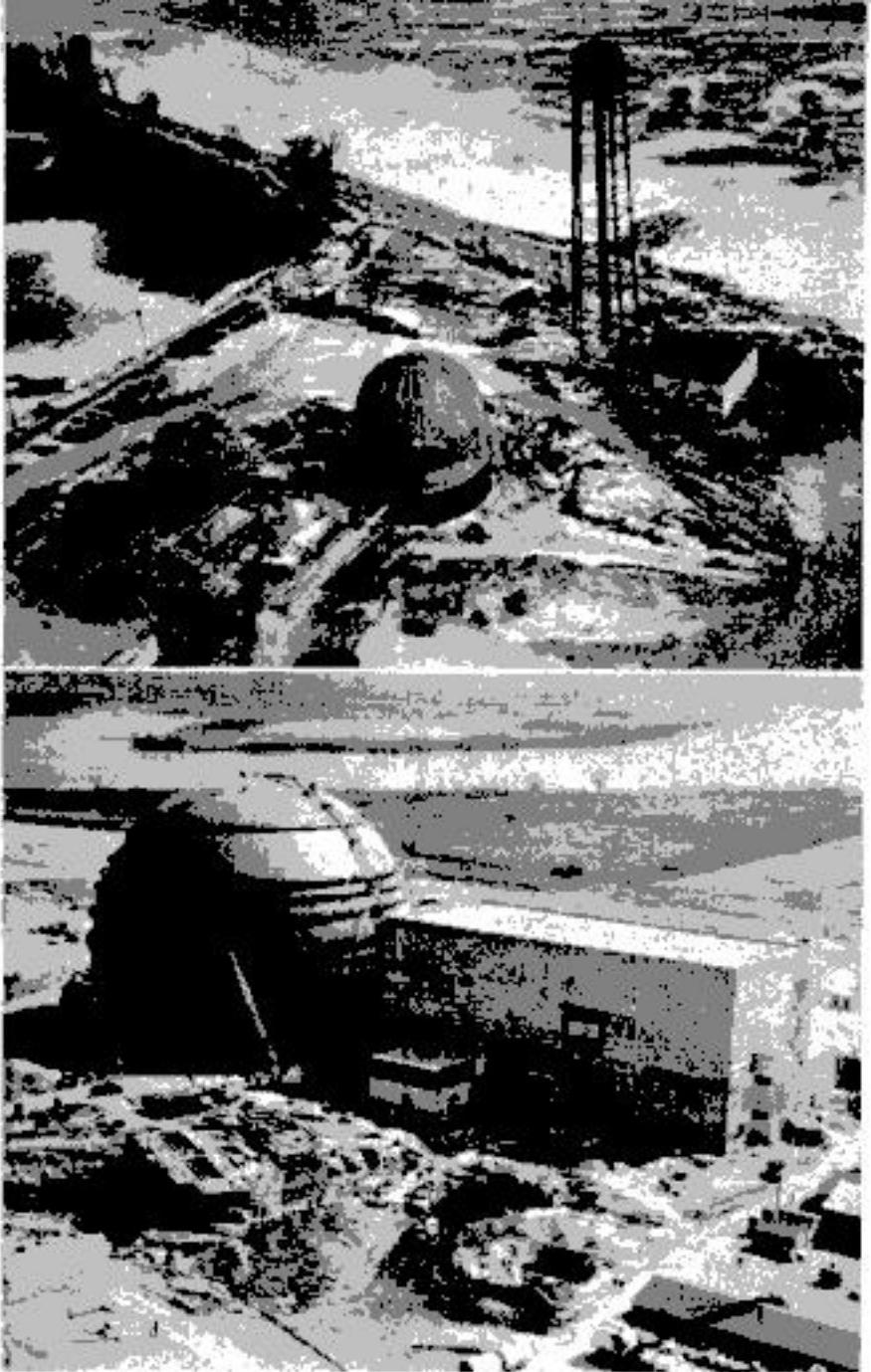
#### Pressurized-water A-power plant



#### Boiling-water A-power plant



**TWO WAYS OF GENERATING A-POWER** are contrasted in diagrams. Pressurized-water system makes steam outside reactor, in separate boiler; boiling-water system, inside reactor itself.



**DOMED BUILDING** of Lagoona Beach A-plant (top view) and 190-foot sphere of plant at Dresden will enclose their reactors to prevent accidental escape of dangerous fission products.

circuits, with its connecting coil which wastes heat."

**One of the handicaps** of all reactors is that they create radioactive "poisons" which slow down the power output so that the expensive fuel must be replaced when only a fraction of the U-235 has been fissioned. Harrer's group is "training" BWR to consume its own poison, thus prolonging the life of the fuel charge. Late in 1956 one experimental BWR was making kilowatt-hours at a theoretical cost of 5.2 cents; now it is down to 2.9 cents and is expected to go lower. This is still a long way from 7.5 mills—the cost of coal-fired electricity at many Illinois plants. But today's cheap electric power was achieved by 50 years of pre-atomic engineering, and the reactor designers are confident that they can hit the same mark in less time.

The big Dresden plant was originally expected to produce power at competitive rates; since then, actual costs have risen by unknown millions. Still another boiling-water plant of 60,000-kilowatt capacity is soon to rise on the northern Cali-

fornia coast, where its builders, the Pacific Gas and Electric Company, also predict that it will reach the great competitive goal.

Some problems of constructing an atom plant are as formidable as pyramid building. A huge, ungainly, 283-ton steel container now being built at Camden, N. J., will house the Dresden reactor. It cannot be shipped by rail, so it will travel by barge down the coast, through the Gulf, and up the Mississippi and Illinois rivers to a wharf a few hundred yards from the plant, there to be nursed into the big sphere with winches and cables. Another giant reactor vessel, transported last April from a factory in Chattanooga to Lagoona Beach, Mich., by rail and river barge, created some of the most difficult moving problems in industrial history. A full-scale dummy was sent ahead on a flat car to test clearance, and a bridge in Indiana had to be rebuilt to let the behemoth pass.

**Another costly trial balloon** in the atomic-power field, the Lagoona Beach plant, being built by a group of 25 utility and manufacturing firms under the leadership of the Detroit Edison Company, will have a capacity of 100,000 kilowatts in 1960. Its current estimated price, 75 million dollars, would build four coal-burning plants of that size. But this is not significant, since it is a "fast-breeder" dual-purpose plant designed to produce more atomic fuel—in the form of plutonium—than it consumes, and it is frankly intended as an experimental stepping-stone to the future.

Before the end of 1960, five of the full-scale plants here described, together with a few smaller ones, will be generating about 700,000 kilowatts—about one-half of one percent of all U. S. electric power. Several other major starts have been made, but the fact that conventional steam and hydroelectric plants totaling 63 million kilowatts are now under construction or in the planning stage is concrete proof of industry's view about how U. S. power will be produced as long as most of us are alive.

A good symbol of our atomic-power dilemma is the fact that the fabulously expensive Shippingport plant is actually built over a deposit of cheap coal. We

[Continued on page 198]

# Midnight Ride on Our Newest Turnpike

**Climb aboard a ship-size  
trailer-truck for a cruise on  
Connecticut's super-road**

**By Edward D. Fales Jr.**

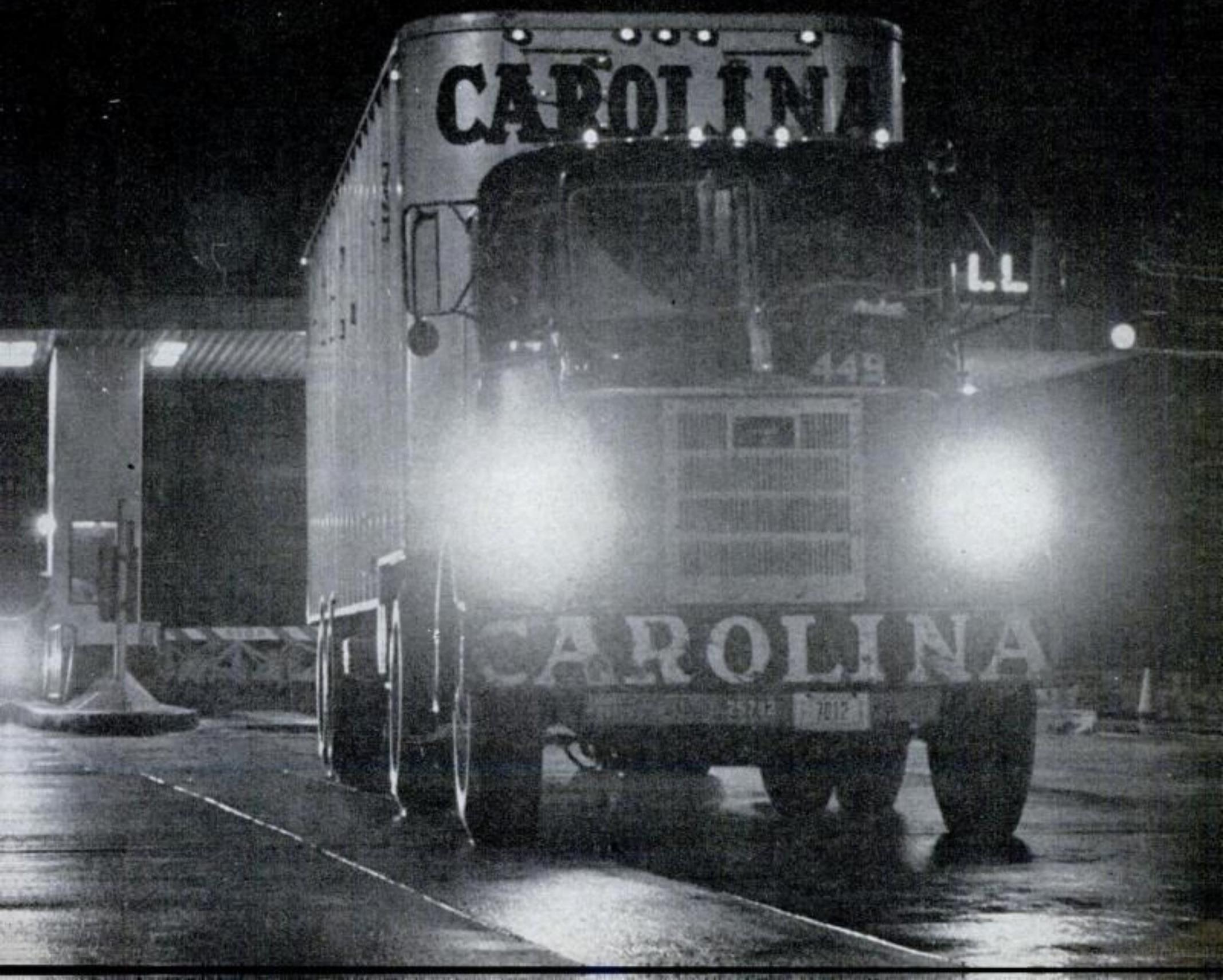
PS PHOTOS BY ROBERT D. BORST

**S**LEEPER NO. 449 swung into the Jersey City terminal of Carolina Lines at 6:09 p.m., 18 hours (and 635 miles) out of Cherryville, N. C. She

paused long enough for orders. I tossed a suitcase high into the cab-over-engine cockpit and climbed aboard. I felt like the pilot going up the side of a ship.

My own orders were to ride Sleeper 449 for 238 miles to Boston and bring back a report. Anyone with a driver's license knows what super-roads have done for cars. I was to find out what they have done for the fellow who makes his bread and butter driving a truck.

I was to bring back a report, too, about



life on today's cross-country freighters. As yet not all truck lines use the growing network of turnpikes—most of them toll roads. Some have boycotted them, in protest against high tolls. I had learned, however, that a few individual truck drivers have been paying their own tolls, and this was significant. What have the drivers found out about turnpike operation that many companies do not know yet?

Tonight I would have a good chance to find out. Part of our way would be over nightmarish U. S. 1, which all truck drivers hate. But then we would come to the nation's newest toll road—the slick new Connecticut Turnpike which bypasses (or goes right over) city after city—20 in all.

**At 6:22 p.m.** I settled in the cab. Co-driver Steve Miller was at the wheel; our skipper, "Cherrypie" Cloninger, was sound asleep in the bunk behind us. No. 449 is a shiny Mack H63 tractor, seven months out of the factory, but with 80,000 miles behind her. ("She may go 800,000 before she's old," Steve said.)

Twice a week No. 449 hauls trailers out of Cherryville, N. C. which is the home base of the Carolina Freight Carriers Corp. Sometimes Cloninger and Miller drive her to Boston; sometimes to Miami. They have friends all along the coast—on trucks, in diners and in garages. Cloninger's first name is Randolph, but other drivers have named him Cherrypie because of his favorite dessert in diners. Many times during the night I was to see Steve and Cherrypie blink lights at other Carolina rigs, Greyhound buses or McLean rigs. ("They're from Carolina, too.")

Miller touched a switch. A shriek filled the cab. "Air starter," he said with a grin. Our 170-hp. Mack Thermodyne diesel burped over pleasantly.

Steve did some sleight of hand with the two gearshift levers in the floor and we pulled out into roaring U. S. 1. "We always start in low second," he said. "We save low for very steep hills."

**6:30 p.m.** Old U. S. 1 is miserable going on a busy night. Brake. Stop. Low second. High second. Low third. Stop. I remembered that someone once figured it costs five cents to stop a car. I wondered what each stop in this 16-wheel monster cost. Steve was hitting most of the lights in high second—by slowing far in

advance. Even so, the wear on a big unit must be great.

"She's pulling heavy tonight," said Steve. "Usually we have 32,000 pounds of freight. Tonight we've got 35,000."

In the big outrigger mirror on my side I saw the shiny Copco "volume van" following us faithfully. In that hi-bob cargo we had aprons, zinc sheets, cigars from Tampa, and ladies' underwear from Georgia. We had ladders, cribs and wooden chests. (I thought: A truck is a ship!)

**7:05 p.m.** Across the George Washington bridge under a necklace of lights into New York City. For one silky moment Steve gets No. 449 into high fourth. "We won't be able to use fifth or high fifth until the Turnpike," he says. High five is overdrive.

**7:10.** Stop. Low second. Broadway. High second. Low third. 179th St. Red light. Downshift. Roll in gear. Brakes. Roll again. Catch the light in second. Sharp right turn. Sharp left. Eight more turns, all to miss a single low bridge.

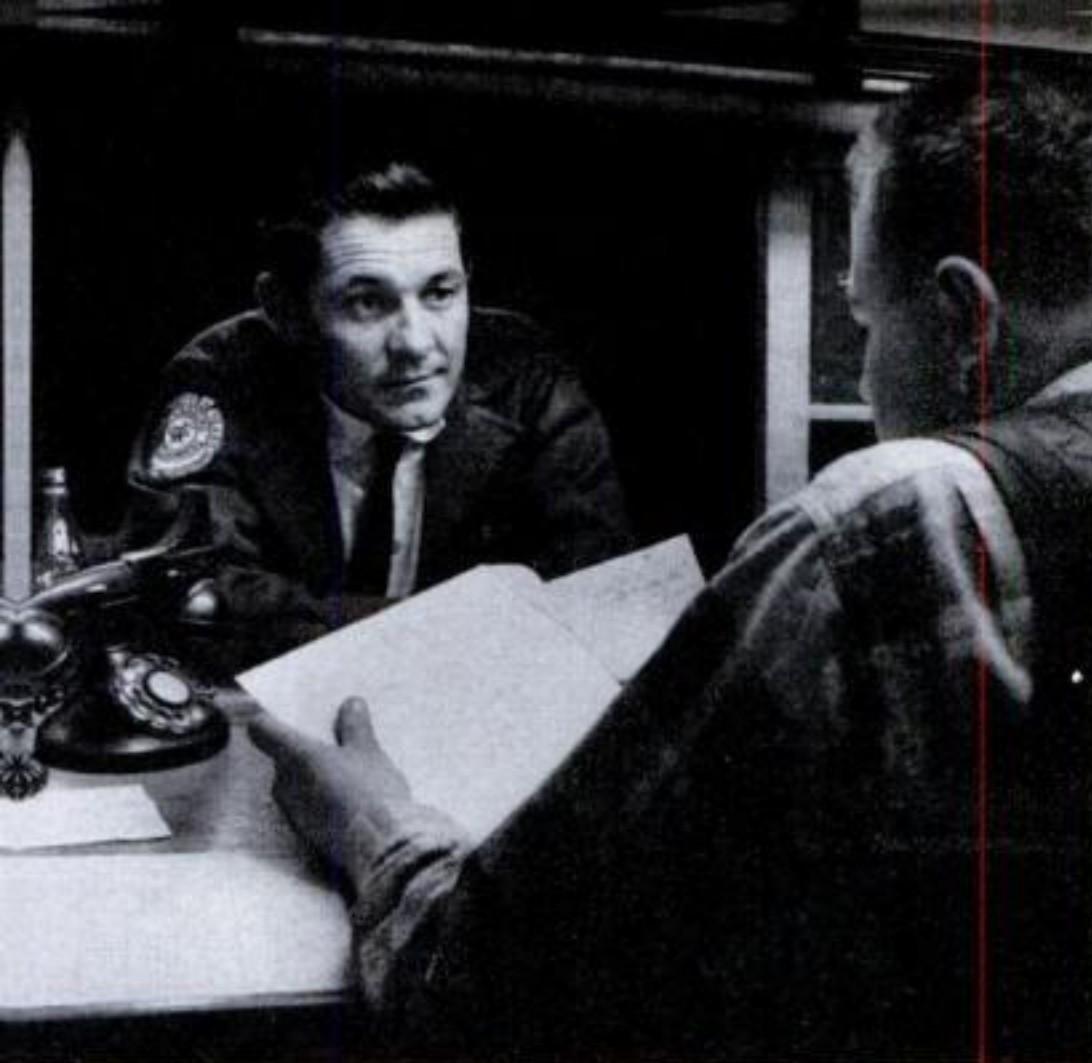
Luckily it was a cool night. On a hot night it would have been maddening. Steve took it in stride. "I try to keep her moving easy," he said, "so my buddy back there won't wake up."

In one jam, I looked around the cab. Under the big wheel was a separate trailer-airbrake lever. "Just in case she wants to come around ahead of us and jackknife," says Steve. "I've only used it twice." On the dash panel was the FWC (front-wheel control) switch, with two positions marked: ROADS WET and ROADS DRY. "We use that when it rains," Steve said. "Helps avoid a jackknife by lowering air pressure on the front-wheel tractor brakes." Since the weather was good, the switch was set for ROADS DRY.

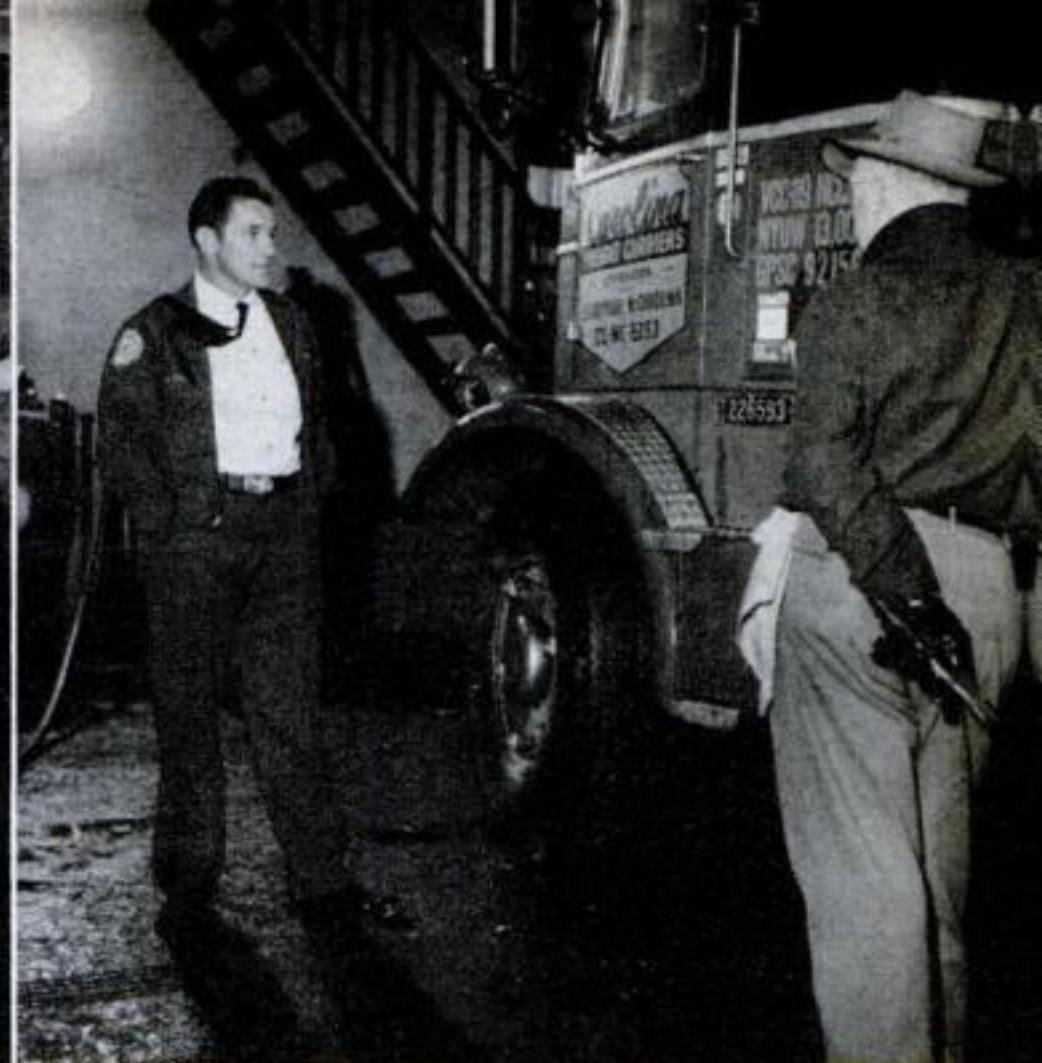
Under the dash was a third safety device: the trailer emergency brake. By flicking the switch, the emergency would go on instantaneously.

On the dash were four reset buttons for the rig's 36 lights. "Ever have your headlights go out?" I asked. "Yes, but never with Carolina," he said. "This outfit checks our brakes and lights every time we come into Cherryville."

The jam broke and we crawled on. Over Steve's window hung a cord. "Air horn. Want to hear it?" he said. He pulled the loop. A blast of music rippled



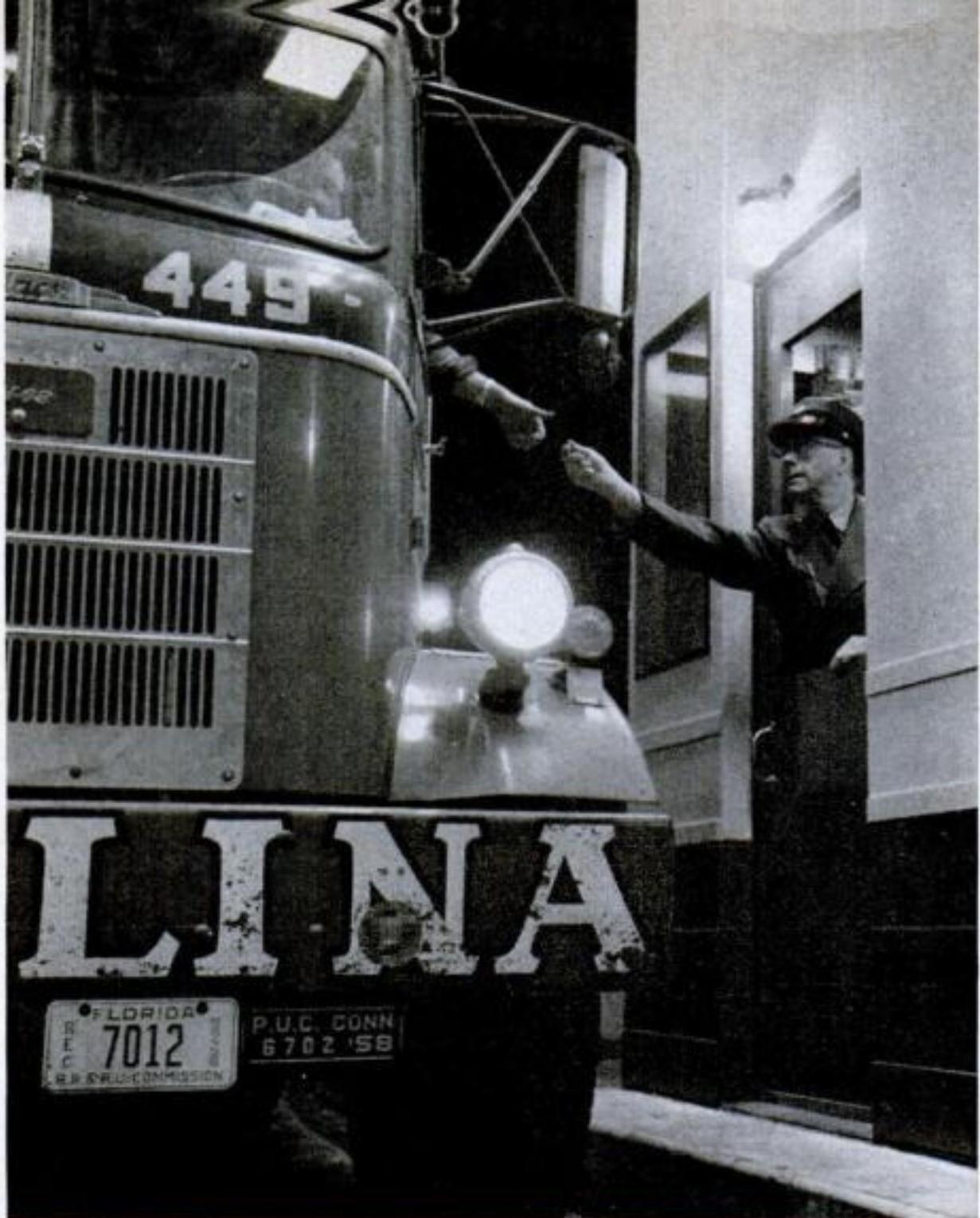
**STEVE CHECKS IN** with company dispatcher at Jersey City, one of 22 Carolina terminals along the Eastern seaboard, from Miami to Boston.



**FUELING UP:** The big diesel takes on a load while Steve gets the latest road news. Even a brief stop like this is welcome relaxation.

Cherrypie kicks a tire. It rings like a bell—so the pressure is okay. A thud means a dud.



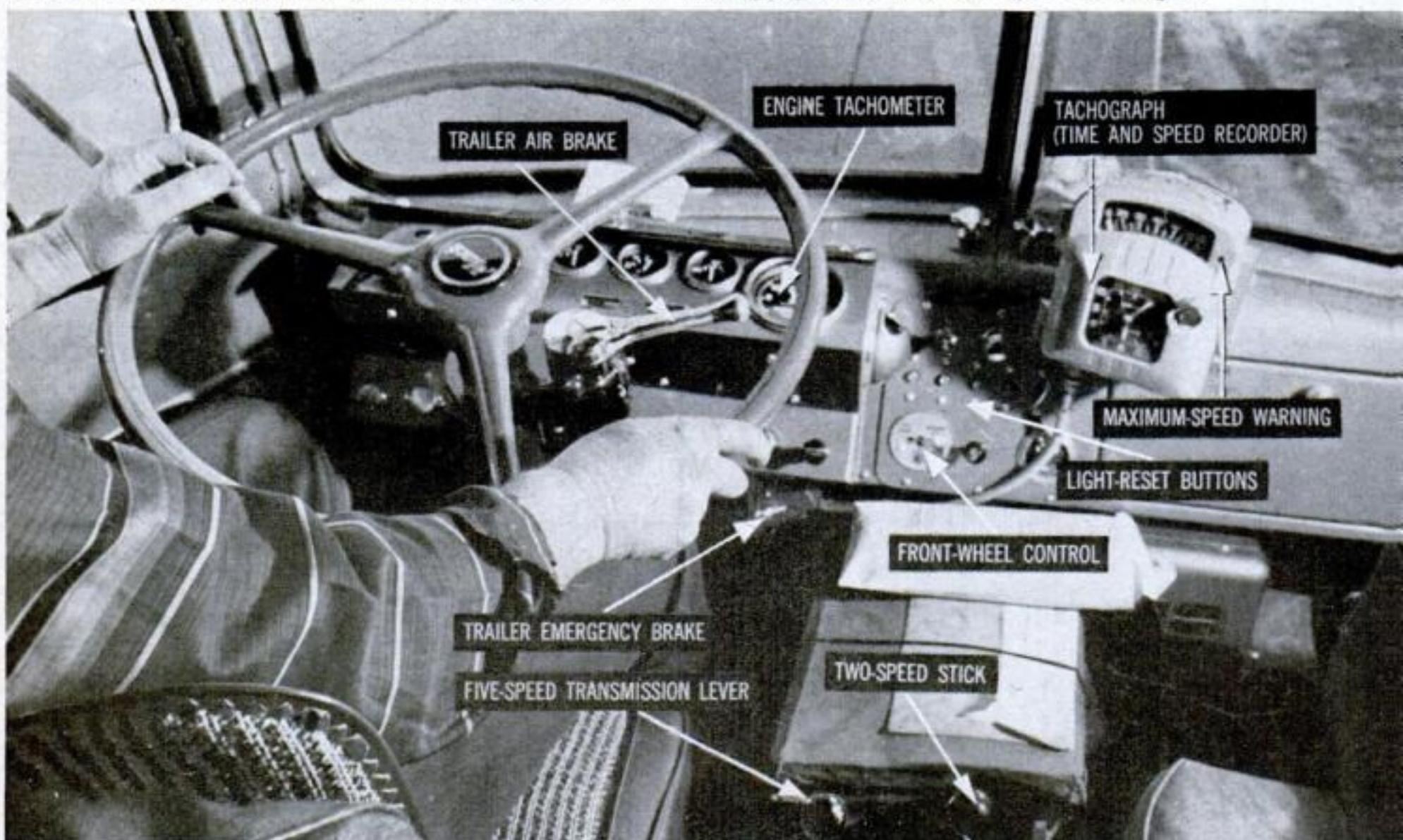


"We pay \$5.05 to use the pike to Boston. It's worth every cent."



Roadside diners offer more

Bracketed before us like a taxi meter, the sealed tachograph records our speed on tape.





than food. Cherrypie (left) and Steve (center) relax and chew the fat with other drivers.

The bunk curtains part on a sleepy face. "Hi," says Cherrypie. Time to refuel the crew.



out into the dusk. (I wondered why auto horns couldn't sound that good?)

Bracketed before us like a taxi's fare box was the sealed tachograph. Inside, a moving pen was recording our speed—at the moment, 12 m.p.h. Steve showed me the tape from the previous 18 hours (No. 449 had left Cherryville at midnight). It showed peak speed of 62—evidently momentary speeds at the bottom of hills. Cruising speeds were bunched from 40-50.

**8:50 p.m.** Mile after mile, bullnosed No. 449 surged along U. S. 1. Port Chester is one massive jam. Steve worked endlessly, right hand never leaving the lever. Some drivers work through the full run of forward speeds, with the "stick" set in low range, and then work back up from third in high range. Not Steve. To keep No. 449 moving easily with its big load he worked virtually every speed through both low and high. This meant an enormous amount of fiddling with the main gear lever (five forward positions) and the stick, which has three positions: low-neutral-high.

Sometimes his hand worked faster than you could see: wham-wham-wham. Hit the stick to neutral, hit the main to third, hit the stick back to high.

"Don't your arms get tired?" I asked.

"You just suddenly get tired all over," he said. "That's why we aren't allowed to drive over 300 miles. My buddy and I change every four or five hours. We never ride together and talk. One is always sleeping. We need that sleep."

## Why Truckers Take the Turnpike

How much time, effort and money had we actually saved on the Turnpike?

*In time*, perhaps 2½ hours. But since we had two drivers, that's five man-hours. (On two round trips a week that's 20 man-hours saved on this 238-mile stretch alone.)

*In effort*, there was simply no comparison. On U. S. 1, Steve Miller had worked like a horse. On the Turnpike all his effort went to smooth, careful operation.

*In wear and tear* (which means hard cash): In one 10-mile stretch of U. S. 1 Steve Miller had shifted 73 times, made 15 "creeper stops" and six full stops. We'd braked 34 times. The wear and tear on No. 449 and trailer (our total weight was 58,000 lb.), on our 16 huge brakes and tires, engine and gears must have been terrific.

By contrast: It cost us \$5.05 in tolls to use the pike. But in 10 miles of the toll road my notes showed no braking, slowing or

Now and then the hi-bob hits a bump and kicks you in the tail. But it's only on the hills that you're really aware of the 35,000 pounds of freight behind your neck. On a steep, winding climb the trailer gets a vague, uneasy drag—the feeling you get in your car when a rear tire softens.

**9:15 p.m.** Suddenly, ahead of us is the Turnpike. No tollgate yet. We roll down the ramp to the glistening concrete ribbons.

Now came the transition. We rolled out in high fourth for a while. The slight vibration in No. 449 took on a new pattern. Our speed went up to 50 and the vibration from the road was like the fast slap of ripples under an outboard cruiser.

Steve pulled back on the stick and we were in smooth overdrive. A red light on the tachograph box flashed red. This was a warning: We were running, at long last, at the company's maximum allowable speed, 55 m.p.h.

Steve settled back. "Now we can roll," he said. No longer was he swinging the big 27-inch wheel, pushing the clutch, fighting the gear levers. No. 449 was cruising.

It's only 38 miles from Jersey City to Greenwich, Conn., and the Turnpike. Our running time was two hours, 38 minutes. We'd averaged less than 15 m.p.h.

*Now the cities began to go by:* Stamford, Darien, Norwalk, Bridgeport. At 10:05 p.m. we hauled off the pike at the

[Continued on page 194]

stopping. No getting the heavy load under way again. No sharp turns. Eight times Steve shifted—but always from high fourth to overdrive, and this hardly seems like shifting. The reduced wear and tear must have repaid our toll several times over.

What this means in steady long-haul driving is shown dramatically in a study made by Eastern Express, Inc. A test truck went over a route by older roads, then made the trip using turnpikes. On a single run from Chicago to Jersey City, pike riding saved:

30.5 gallons of gas

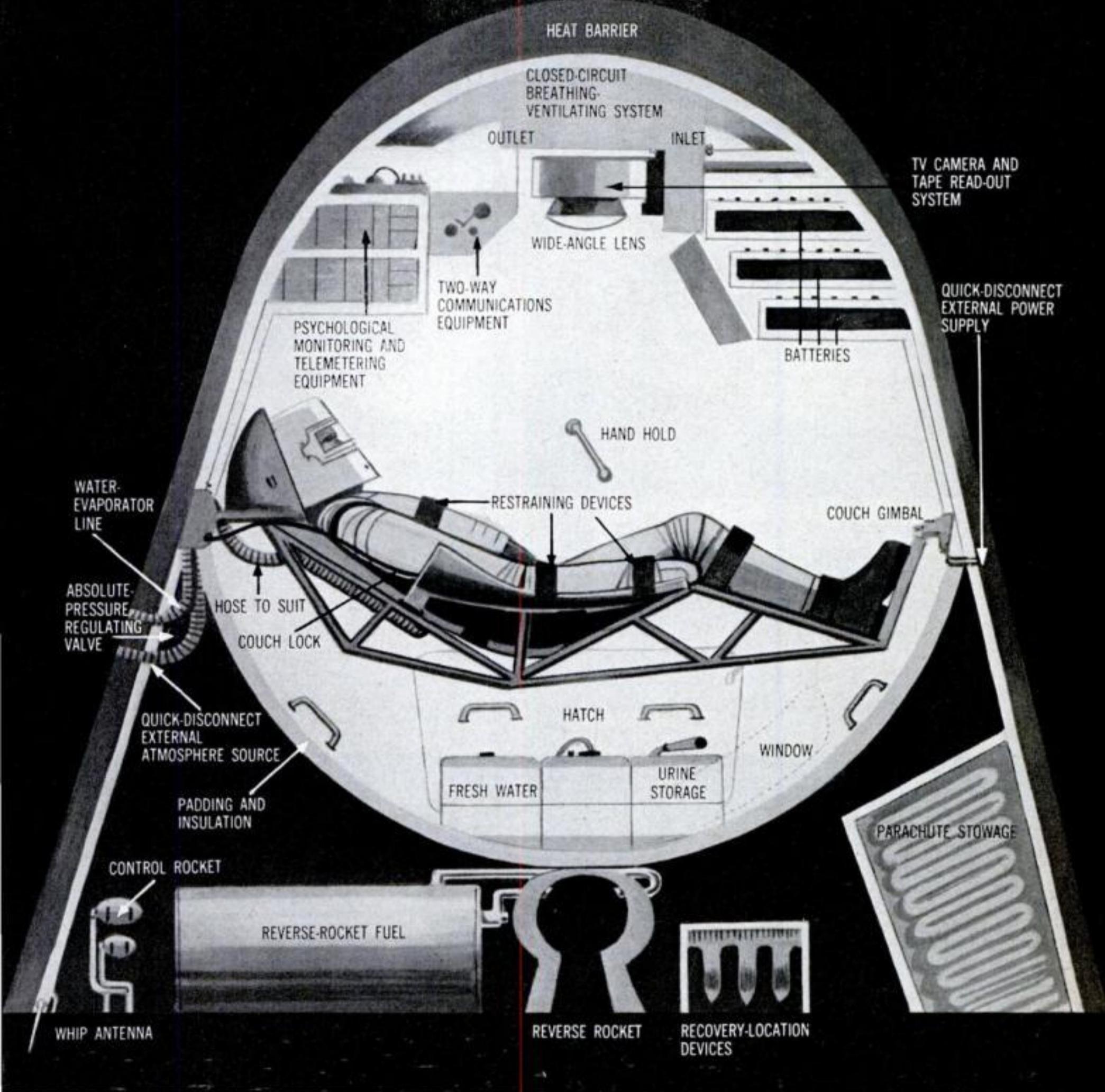
11½ hours actual running time

696 brake applications

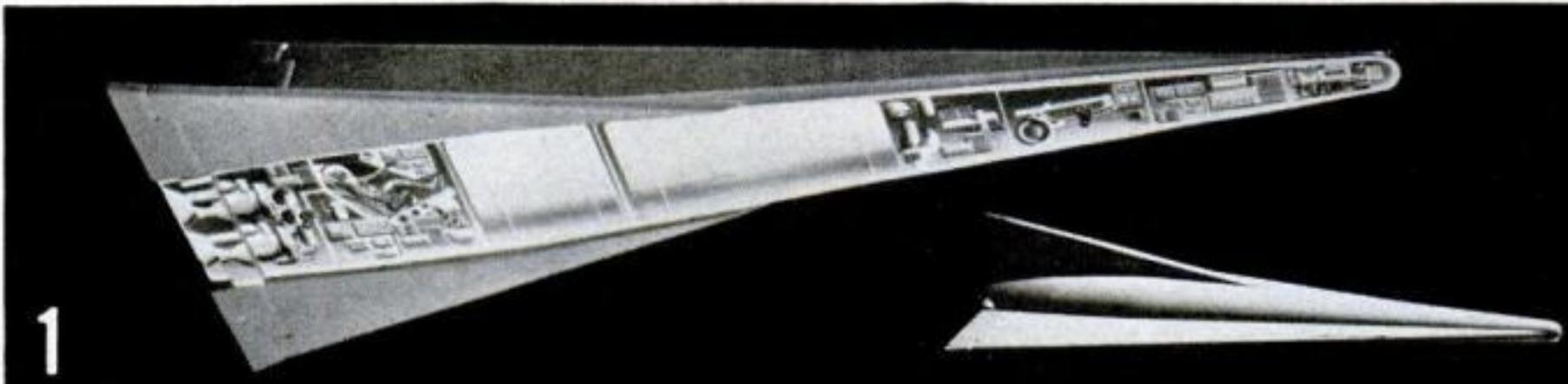
185 full stops

In addition, the truck averaged at least eight m.p.h. faster. But it is in gearshifting that the saving really shows up:

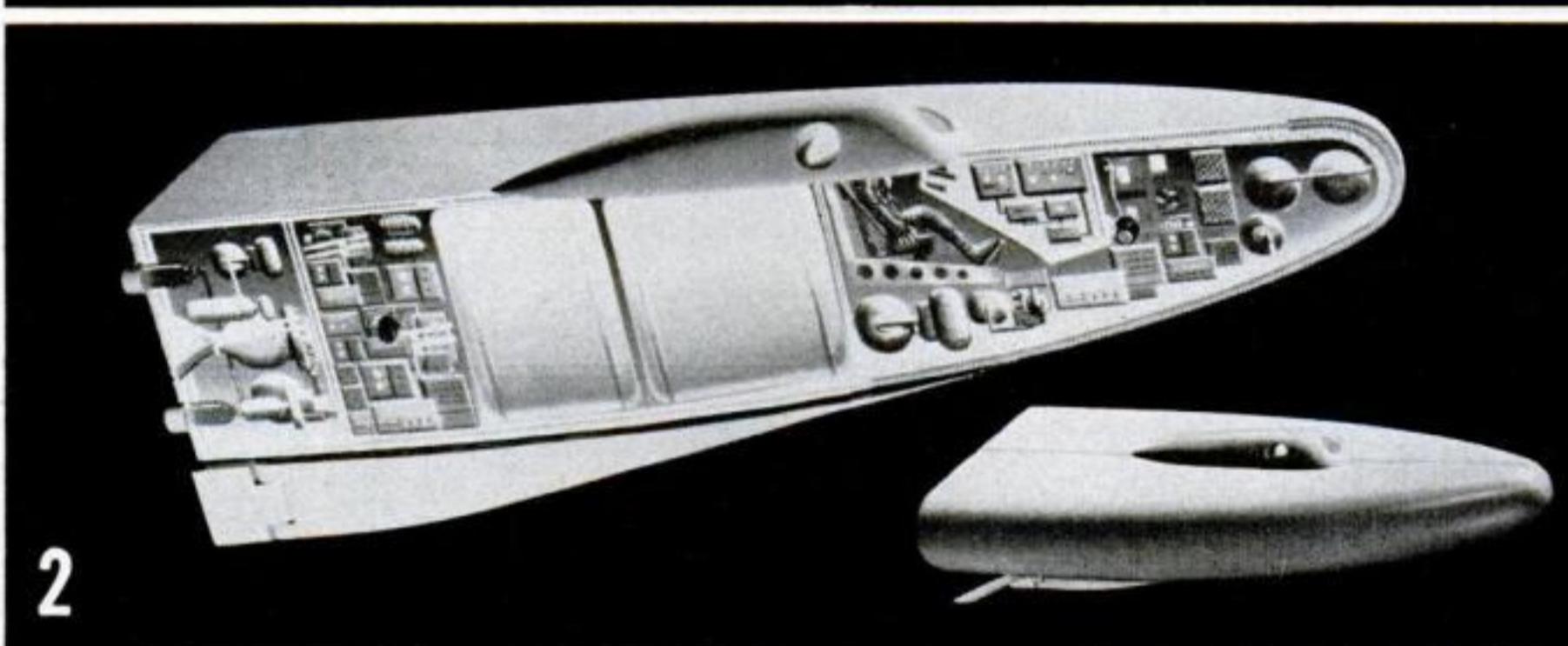
Over older roads, the test truck made 3,116 gearshifts. But by turnpike it shifted 777 times—an almost incredible saving of 2,339 shifts in a single trip.



**Man in space.** Late this summer picked U. S. Air Force personnel start pre-spaceflight training. Here is one way they may eventually go beyond the earth's atmosphere—and return. This conception of an orbital nose cone by *Air Force Magazine* shows the spaceman wearing protective clothing and reclining on a padded couch to protect him from high G forces during acceleration. He will breathe closed-circuit atmosphere; his physiological reactions—heart action, temperature, respiratory rate—will be telemetered to earth. Turn the page for more on manned satellites.

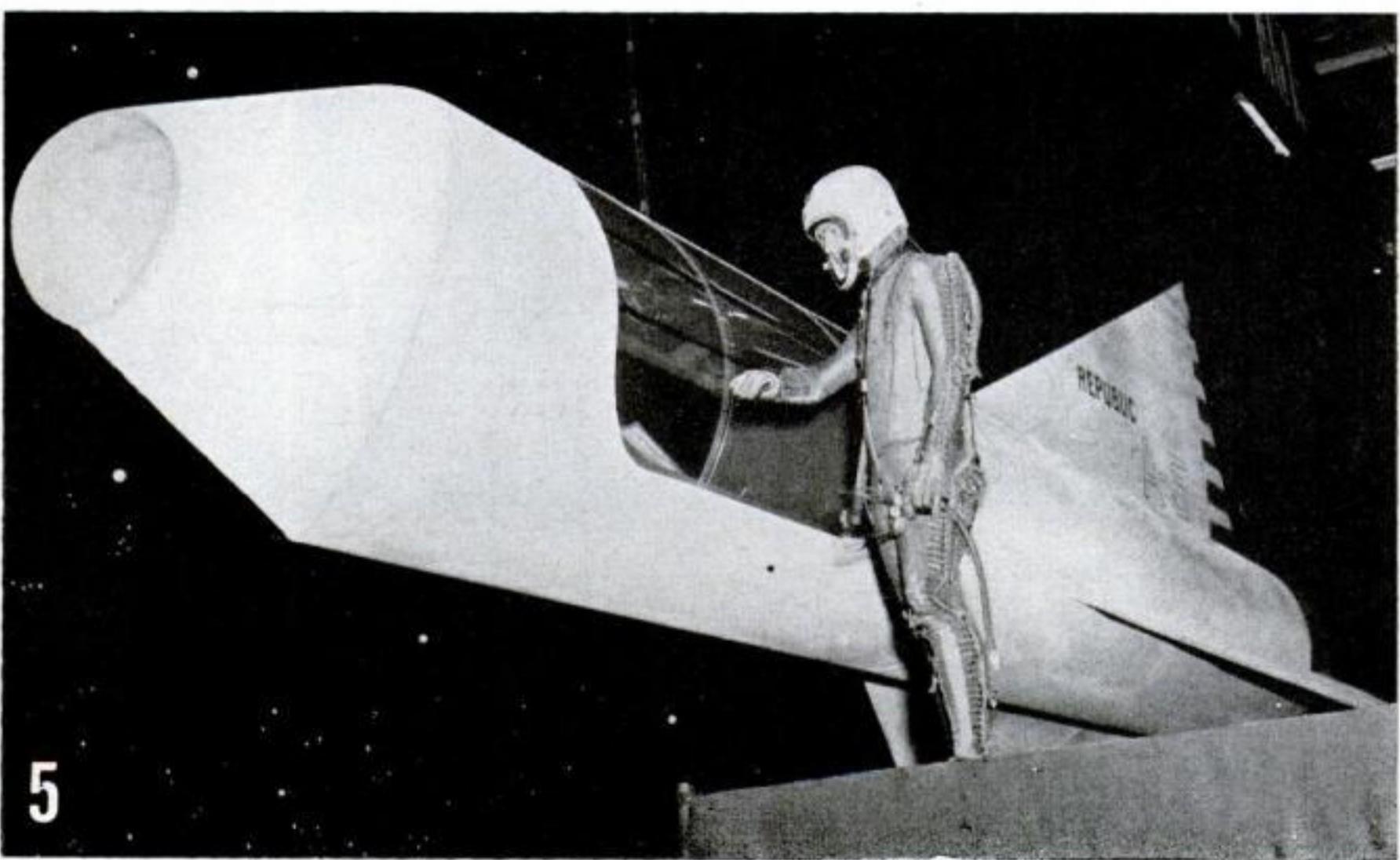


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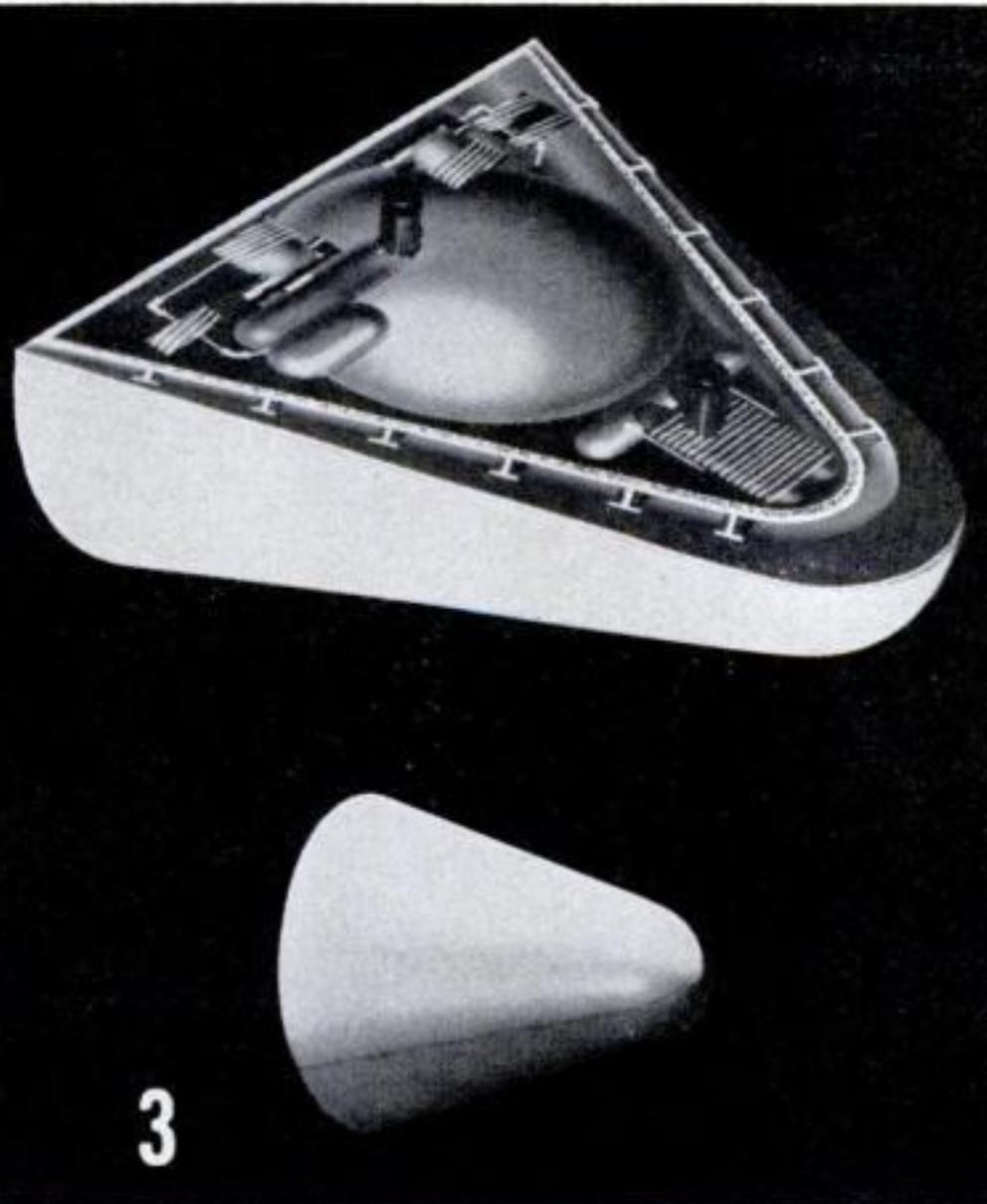


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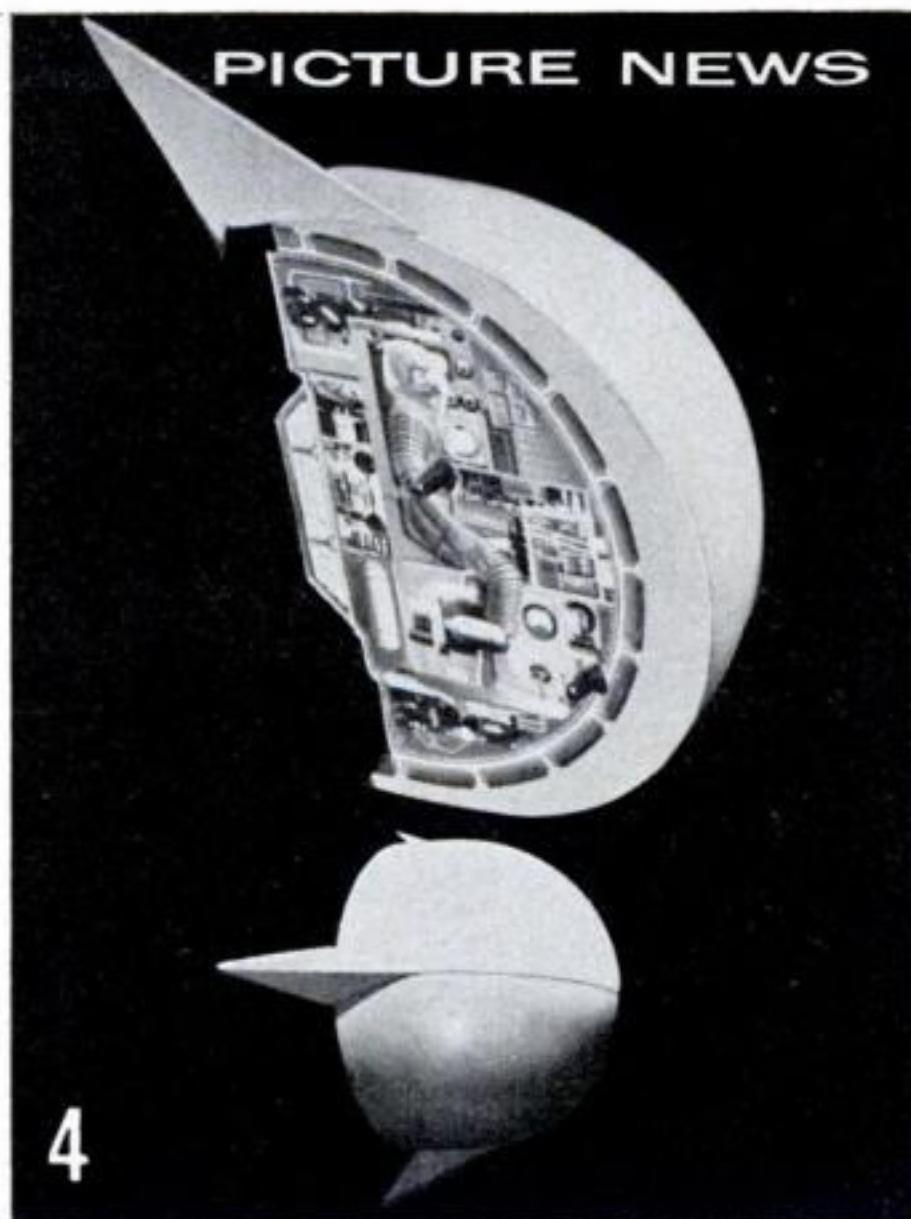
**Man in space** (cont.) Here are four suggestions by the National Advisory Committee for Aeronautics for manned satellites that could be put in orbit and brought back. A delta-wing vehicle (1) would have a blunt nose and blunt, highly swept wing and fin leading edges to reduce heating. Wider choice of landing area is possible with a "motorboat" satellite (2) that could land on water. Both would have re-entry and landing controls. The ballistic-missile design (3) has a copper-shell heat shield thickest at the nose with an air gap and insulation separating it from the



3



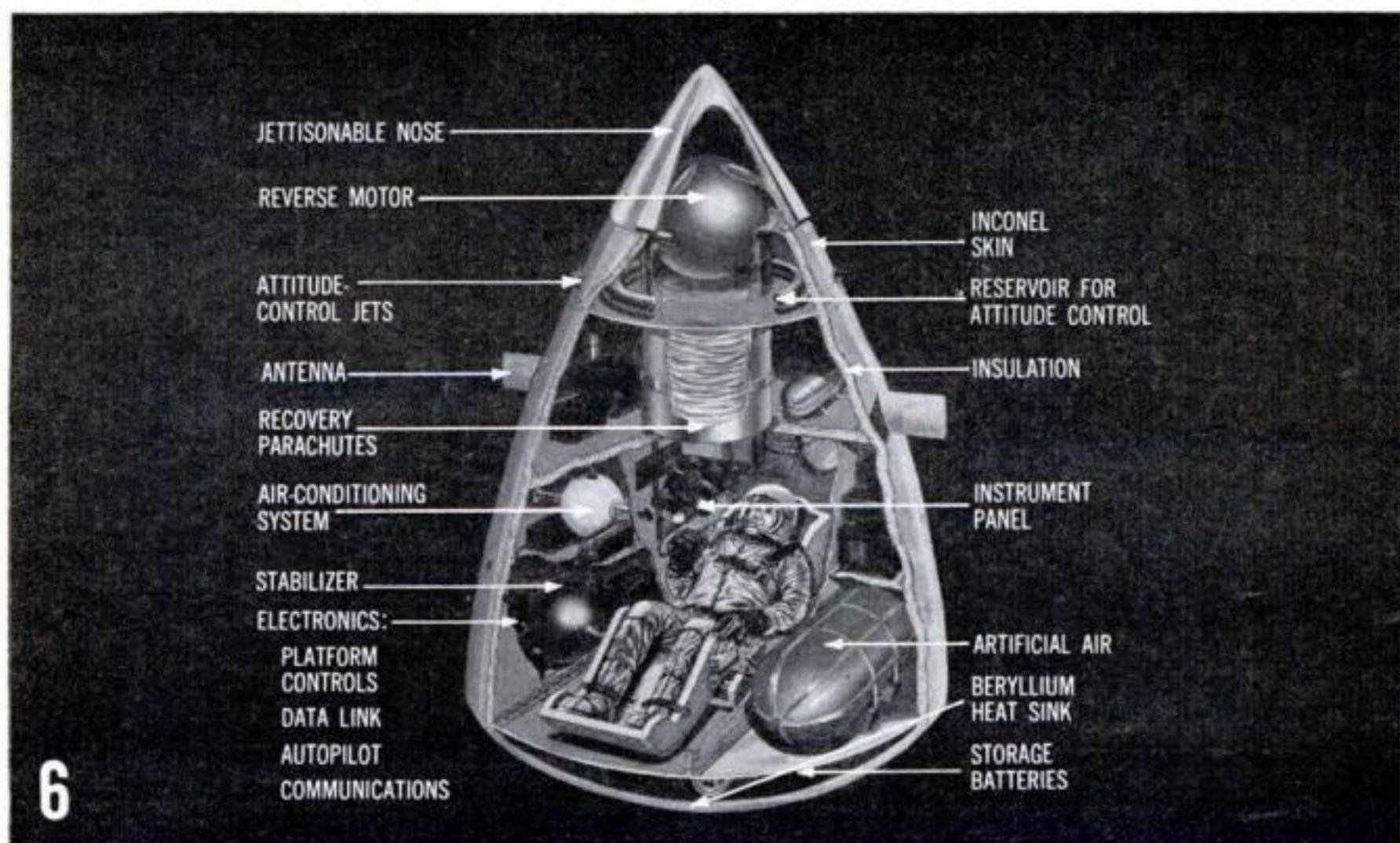
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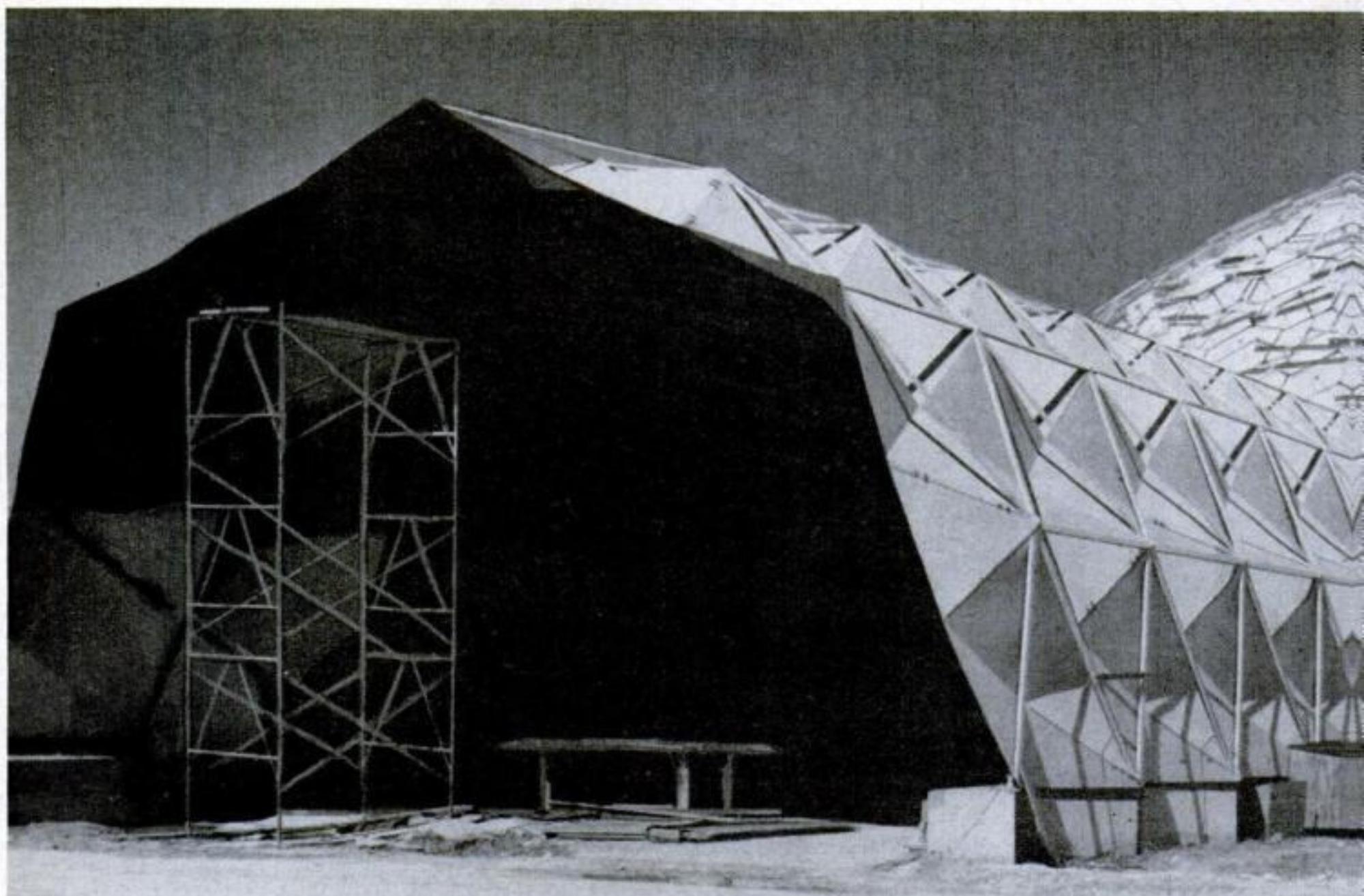
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inner capsule. A beryllium oxide outer shell of a hemisphere (4) is insulated on the inside. The man is nearly vertical in launching position.

A 32-foot model of a re-entry vehicle (5) was shown by Republic Aviation in an exhibit dramatizing the possibility of rocket-launched moon satellites and space exploration. Northrop Aircraft has developed a basic design (6) for a recoverable manned "space laboratory" it says could be launched by an existing intercontinental ballistic missile in three years. Contemporary rocket engines would boost it into orbit.

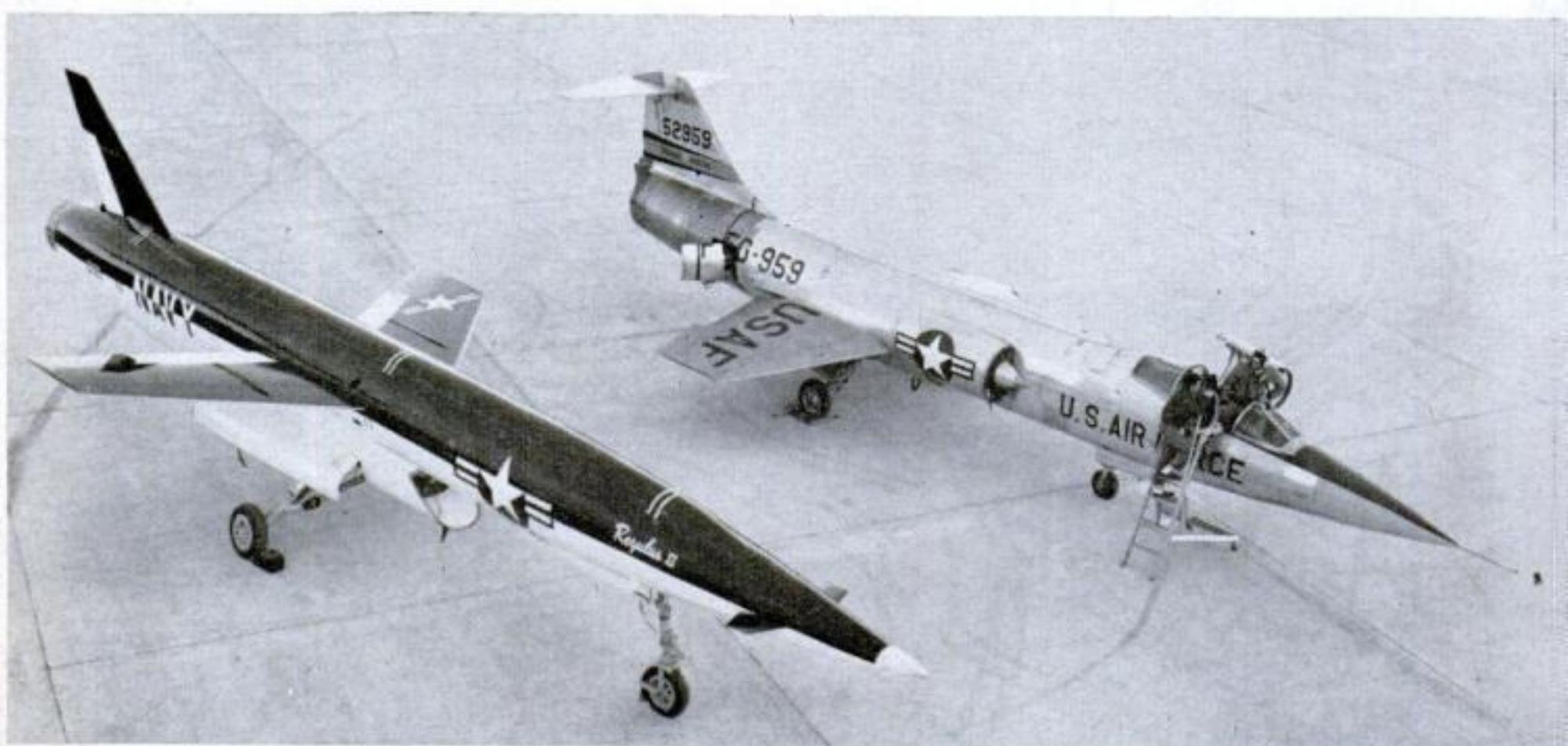


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**Geometry in steel.** This huge domed building, largest unsupported expanse in the world, is 375 feet across and stands 116 feet high. It was designed and built by Union Tank Car Co. for inspection, maintenance and repair of tank cars at Baton Rouge, La. There are no pillars or

**Missiles, manned and unmanned.** These sleek bodies are each wrapped around a GE J79 jet engine which powers them at a speed of Mach 2. The look-alikes: left, Navy's Chance Vought Regulus II guided missile; right, Air Force's Lockheed F-104A Starfighter interceptor.

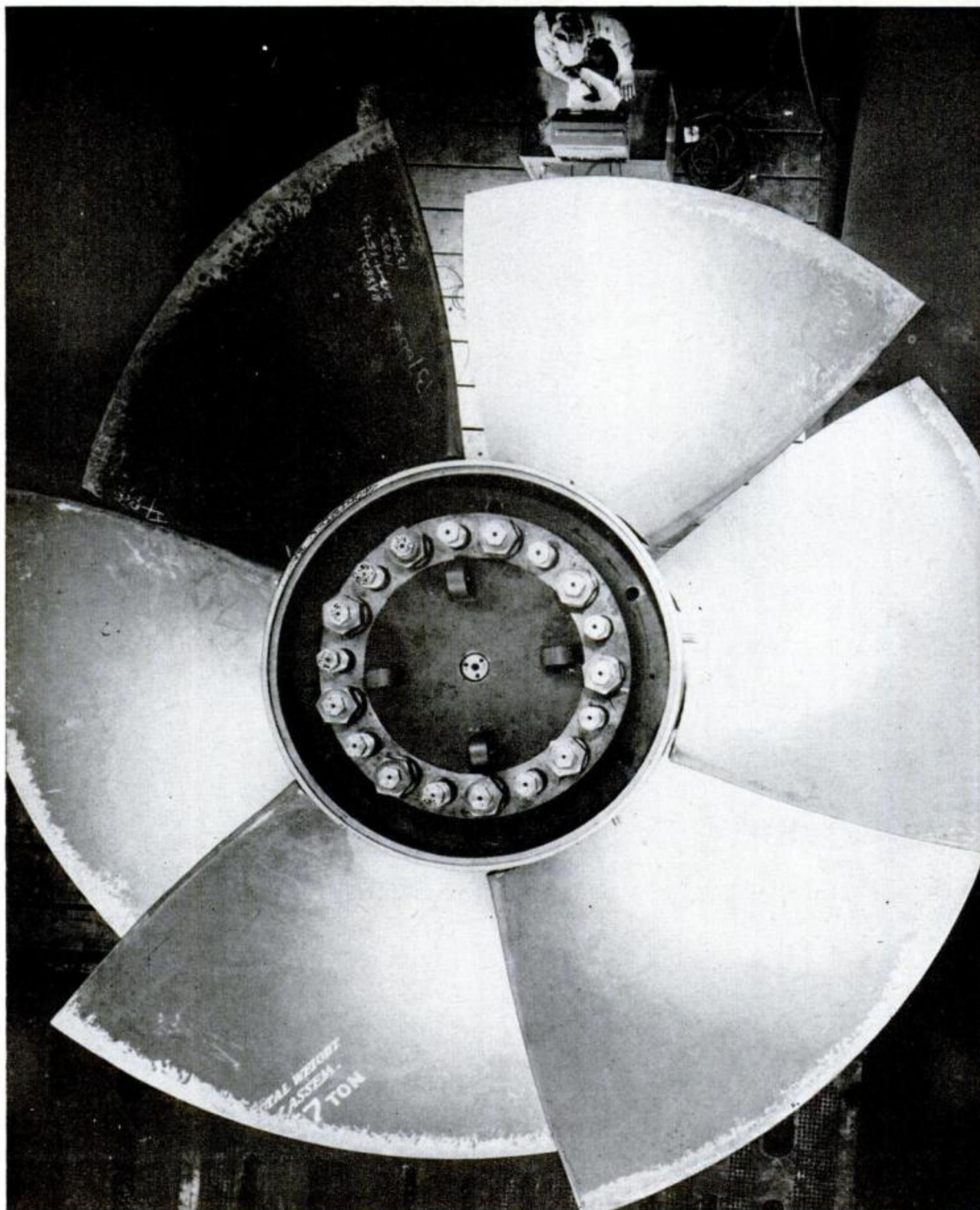




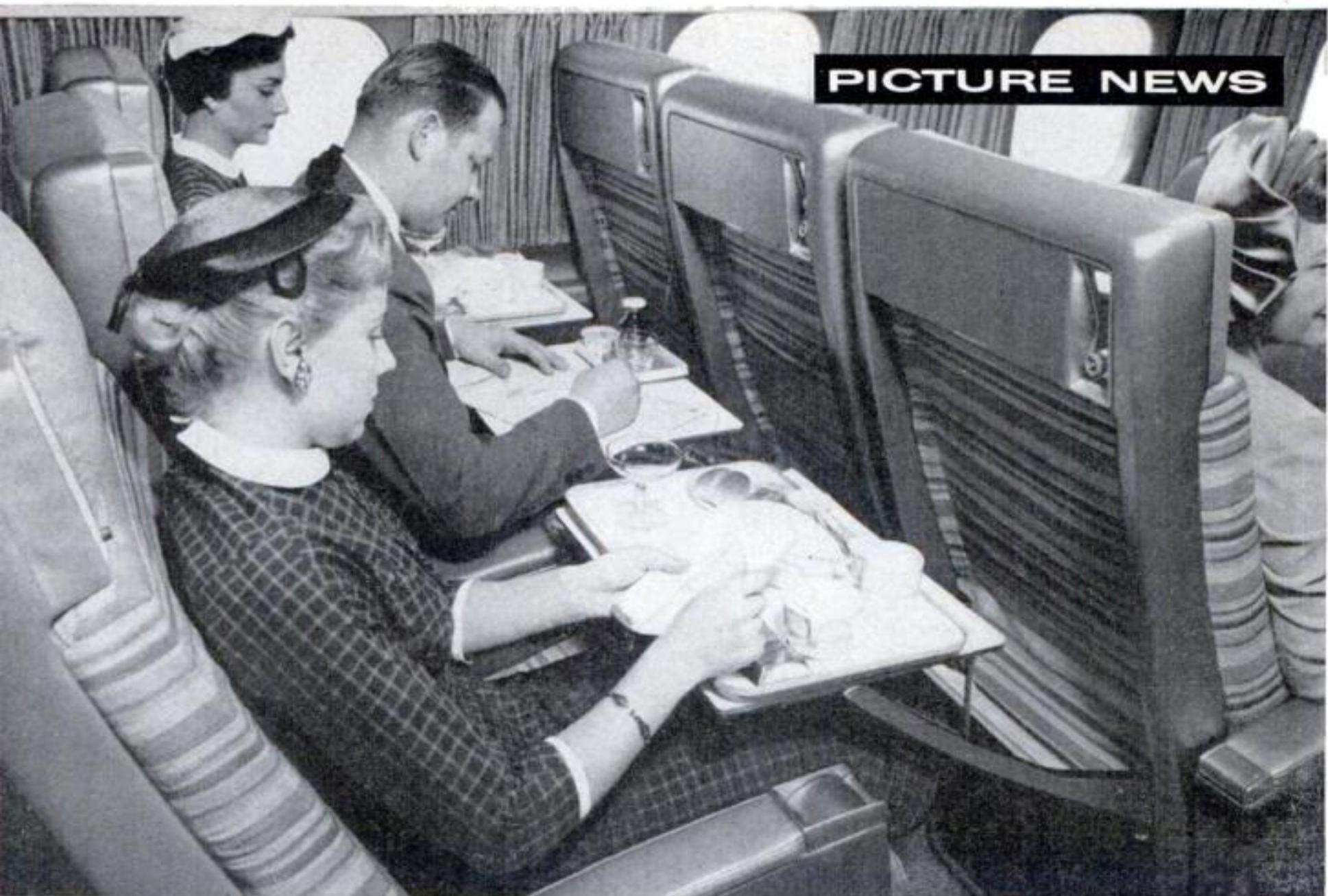
girders to hold it up—support comes from 320 triangular eighth-inch steel plates and four-inch tubing fitted into a geodesic pattern. A total of 110,000 square feet of work space is provided under the dome. The tunnel-like extension at left is a paint shop, 200 feet long and 20 feet high.

**"I followed too close!"** So says this sign in German on the autobahn between Frankfurt and Mannheim. Authorities have turned to humor in an effort to highlight one of the most important causes of smashups on the express highway, which has the highest accident rate in Germany.





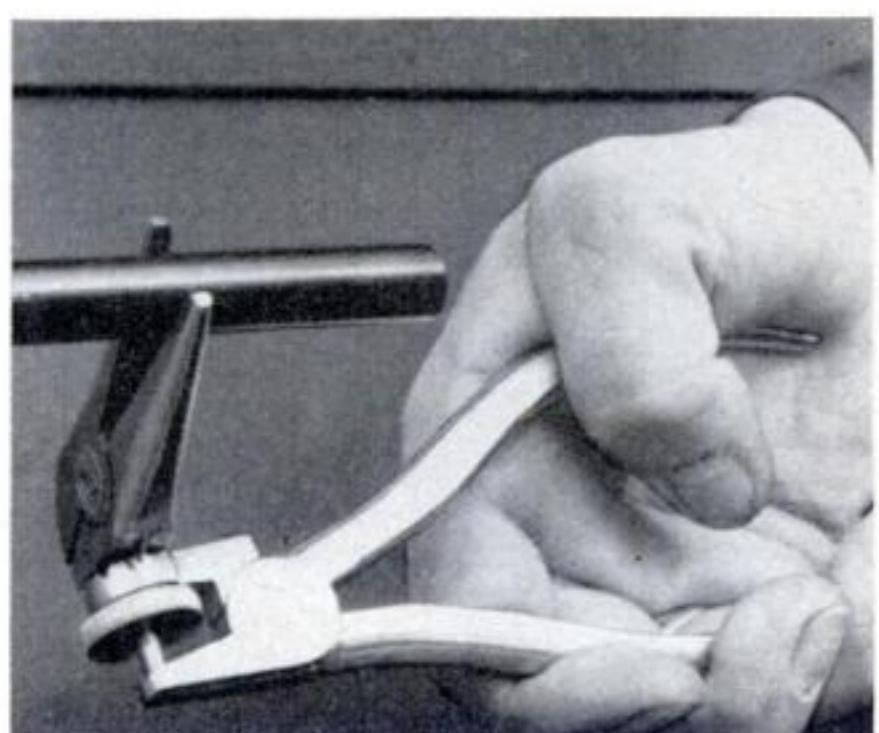
**Behind the St. Lawrence's power.** Eight giant rotors like this are being supplied for turbines at the Barnhart Island powerhouse of the St. Lawrence power project near Massena, N. Y. The blades are being balanced here on an electronic device in the Allis-Chalmers shops. Each turbine will develop 79,000 hp. at 94.7 r.p.m. under a hydraulic head of 81 feet. Turbines, of latest design, have automatic lubrication.



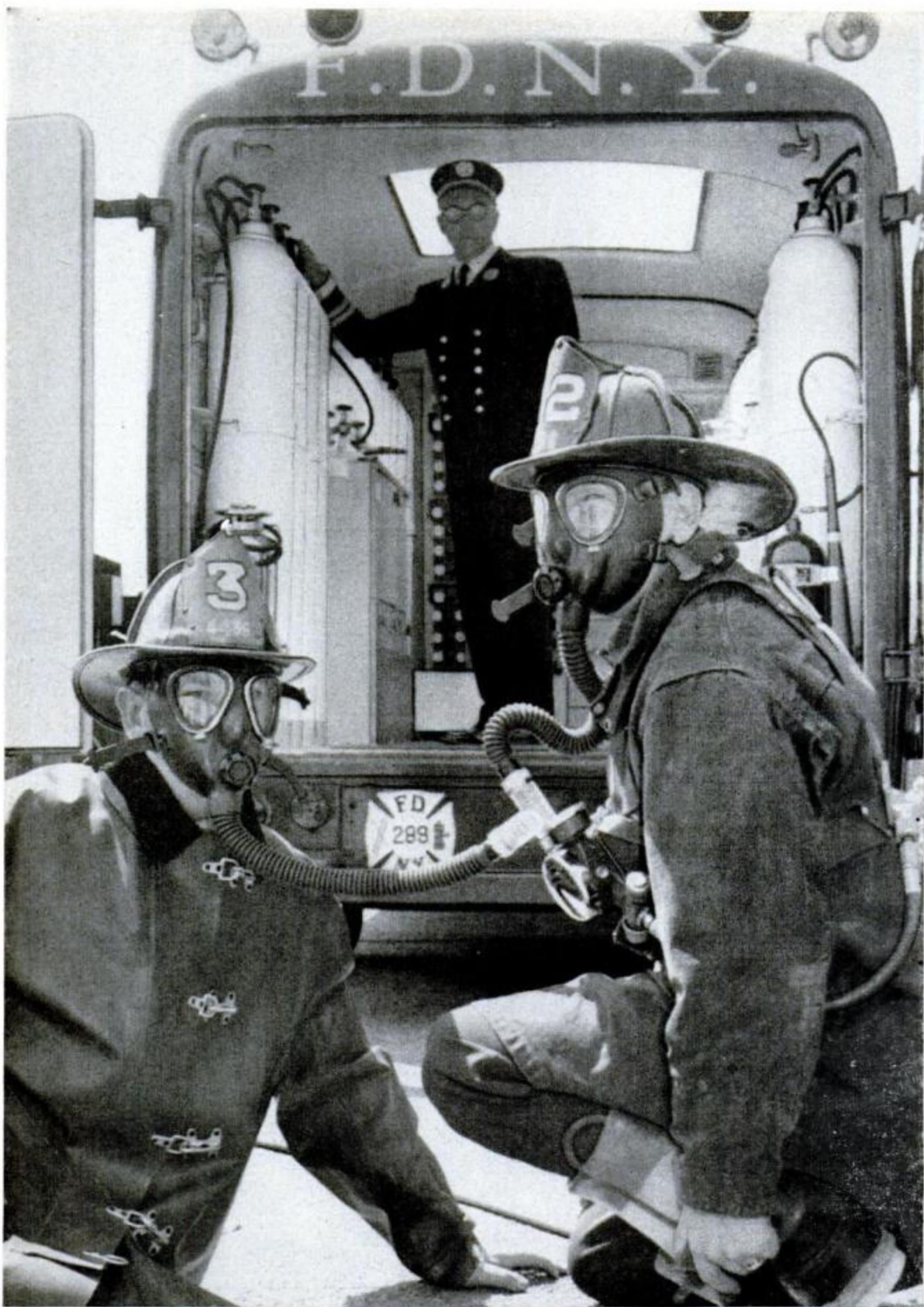
**Comfort in jet airliner.** Steady fold-up tables to hold meal trays or provide writing space while traveling at speeds over 500 m.p.h. are in the offing for jet airliners. These, on the Douglas DC-8 scheduled to go into service late in 1959, fold into the seat ahead. Supporting arms keep them at the same height even when the seat back is being adjusted for position. Seats have shoulder-high reading lights, cold-air outlets.



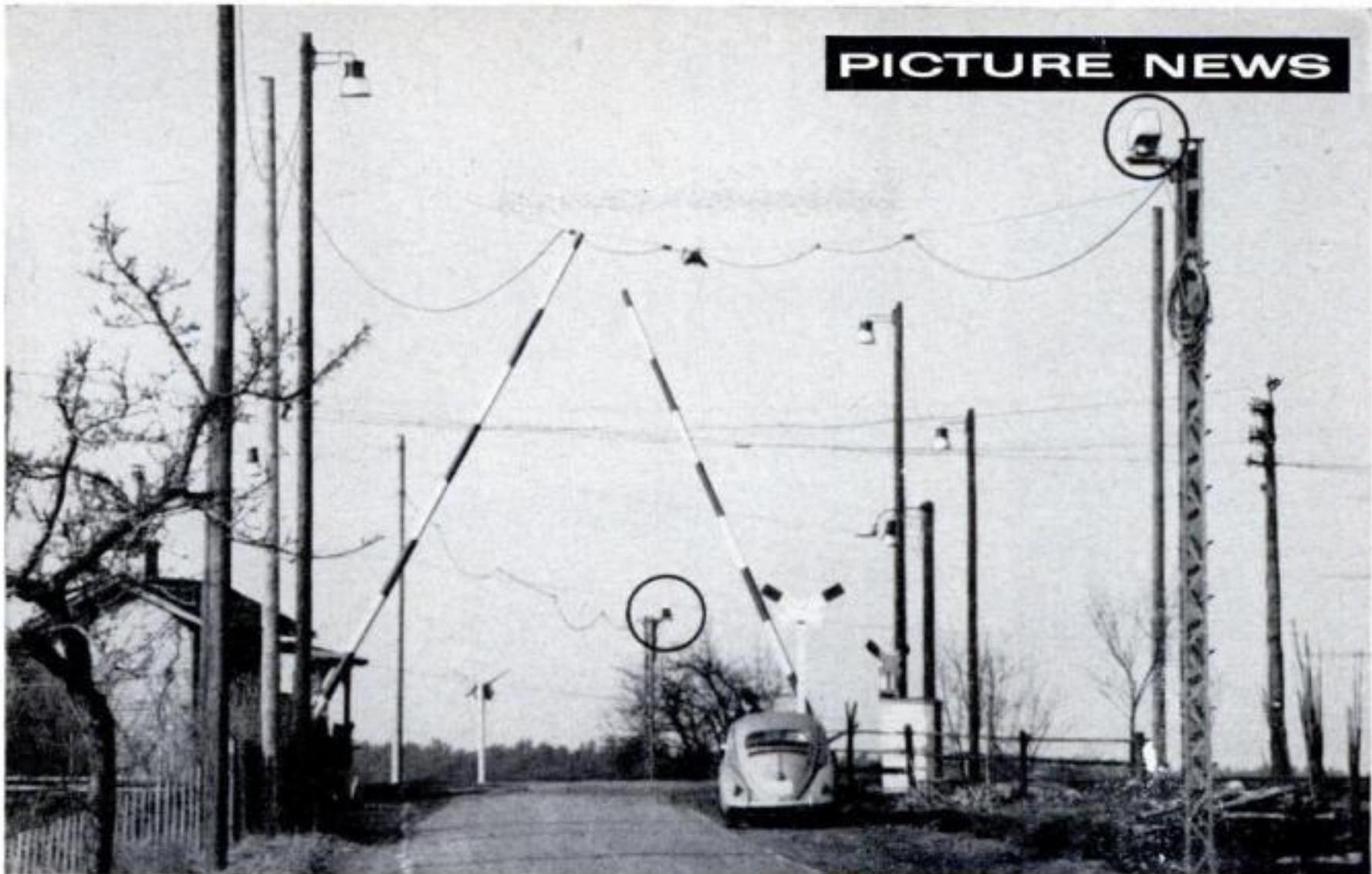
**Solar-powered ears.** This eyeglass-type hearing aid works on cells powered by the sun or other light—even a flashlight provides kick. Zenith also has a nickel-cadmium battery in the temple bar to store charge for use in the dark.



**Swivel-nose pliers.** Jaws that can be rotated 360 degrees give these German pliers access to tight spots in radio and other work. They lock at various angles. The jaws are closed by a floating push rod when the handle is gripped.



**Air for firefighters.** Using a special connection, the fireman at right can pass air from his own mask into the mask of a man trapped in a hole or between walls. The rescue truck, developed by New York's Fire Department, carries enough compressed air to supply a victim for 48 hours, or refill 100 portable air cylinders at the scene of the fire.

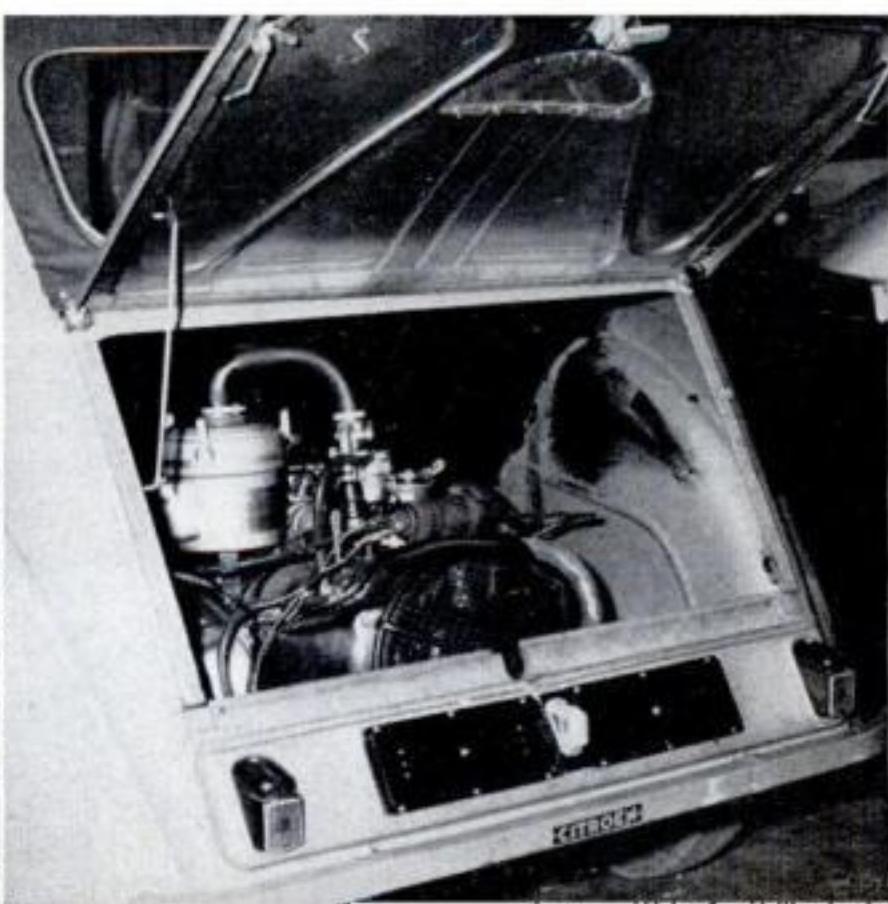


**TV guards RR crossing.** Instead of installing automatic gates at little-used crossings, the West German railroads are trying out a new system using television for remote control of highway traffic.

At this initial setup near Dieburg, two TV cameras mounted on top of iron masts (in circles) flash pictures of both sides of the crossing to screens in a central station. The guard in attendance, with a constant view of the traffic pattern, can lower or raise the gates as required.



**Power fore and aft.** This Citroen has two engines. One in front drives the front wheels; the back one, which can be cut in or out, the rear. Together they do 70 m.p.h., climb a 40-percent grade and get 28 miles on the gallon. Developed for oil exploration in the Sahara, the extra-engine car will be available in the U.S. about November.





**Grocery guide talks back.** This electronic supermarket directory speaks right up. It may say, for instance, "Tomato juice, counter eight, aisle two," depending on the button you punch. Made by Eastwood Industries, Chicago, it uses a switching system for recorded messages.

**Copter flying boat.** A new helicopter with a V-bottom hull surges over the water like a powerboat. Sikorsky's S-62 is the first rotary-wing airplane specifically designed as an amphibian. Its boat-shaped fuselage cushions water landings, throws spray outward and down. Wheels are set in stabilizing pontoons. It carries 12, is powered by turbine.





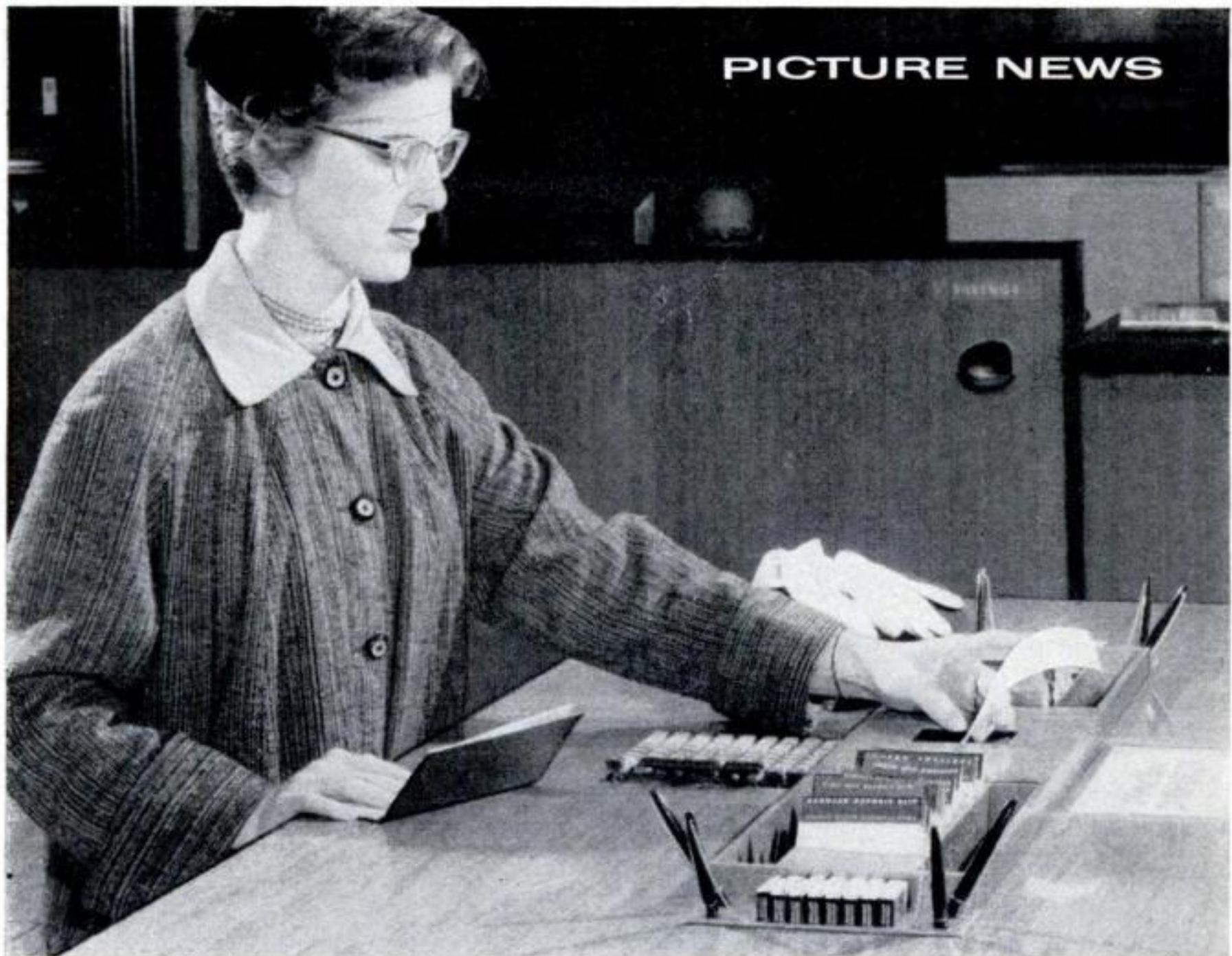
**Fire and foam.** This grotesque figure sloshing through a sea of foam could be a welcome sight to pilots and men on H-bomb planes. A fire fighter stationed at the U. S. Air Force base at Alconbury, England, he is shown during a practice drill in which a bomber was set on fire. Using flame-smothering foam, the ground crew extinguished the blaze in four minutes.



**Rolling on 22 wheels.** This truck rides 9,300 miles of Michigan highways to measure what traffic does to them. Recording wheels at the center, 16 small wheels at front and rear, and sensitive instruments detect irregularities in pavement and any difference in height between wheels.

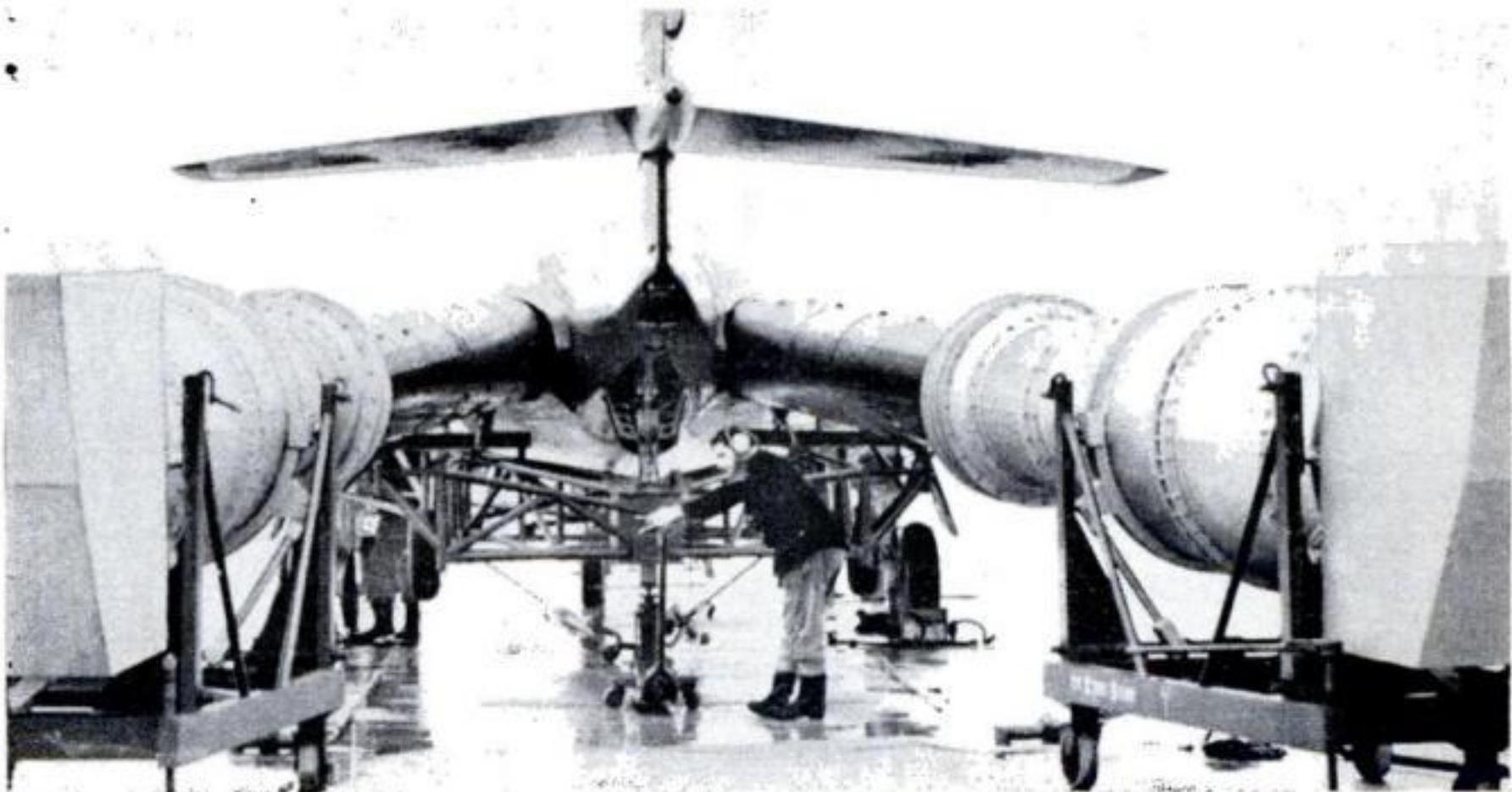
**Jet chaperone.** Streaking at supersonic speed, an Air Force F-100 interceptor is pacing a new turbojet Mace guided missile on a 600-mile flight to test its preset guidance system. If anything goes wrong, the jet and a companion are ready to destroy the missile instantly.

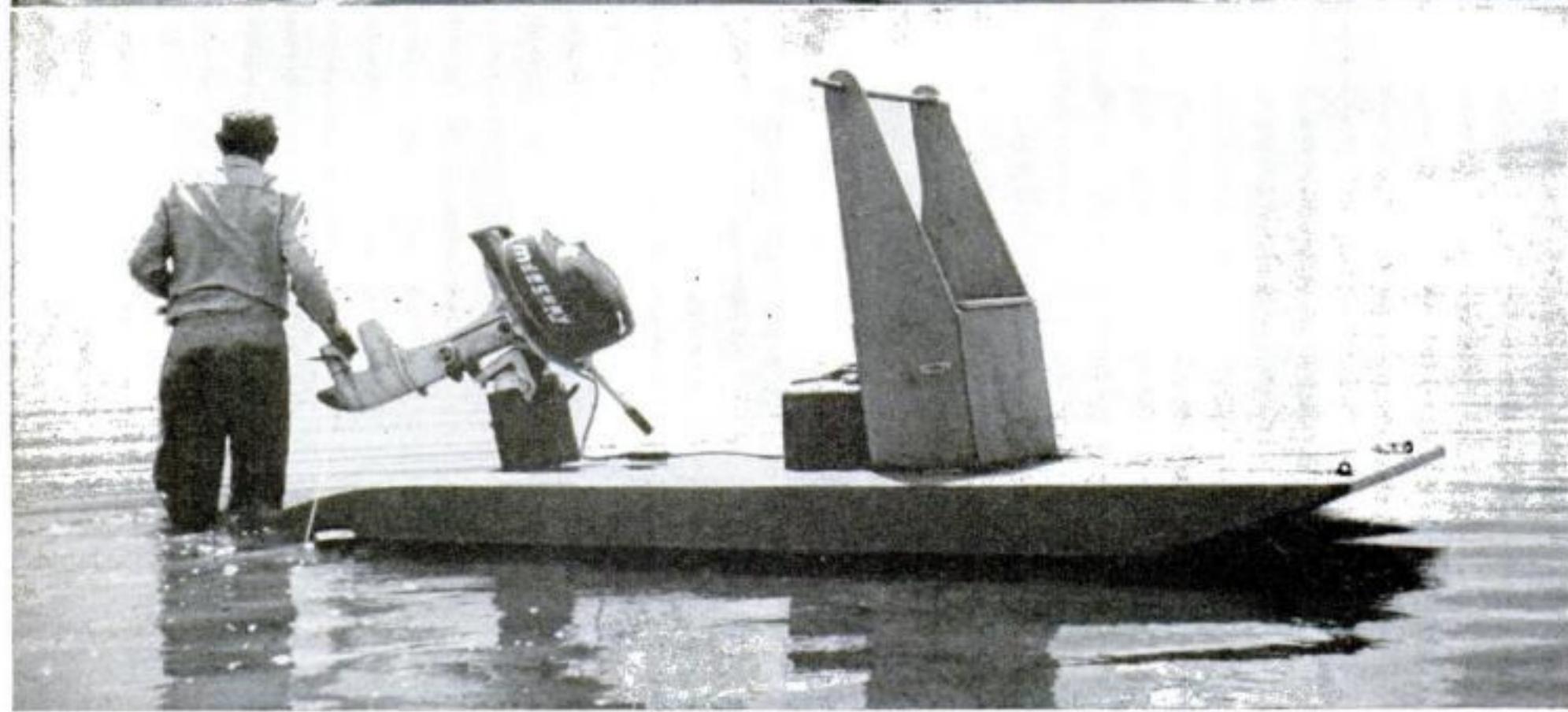
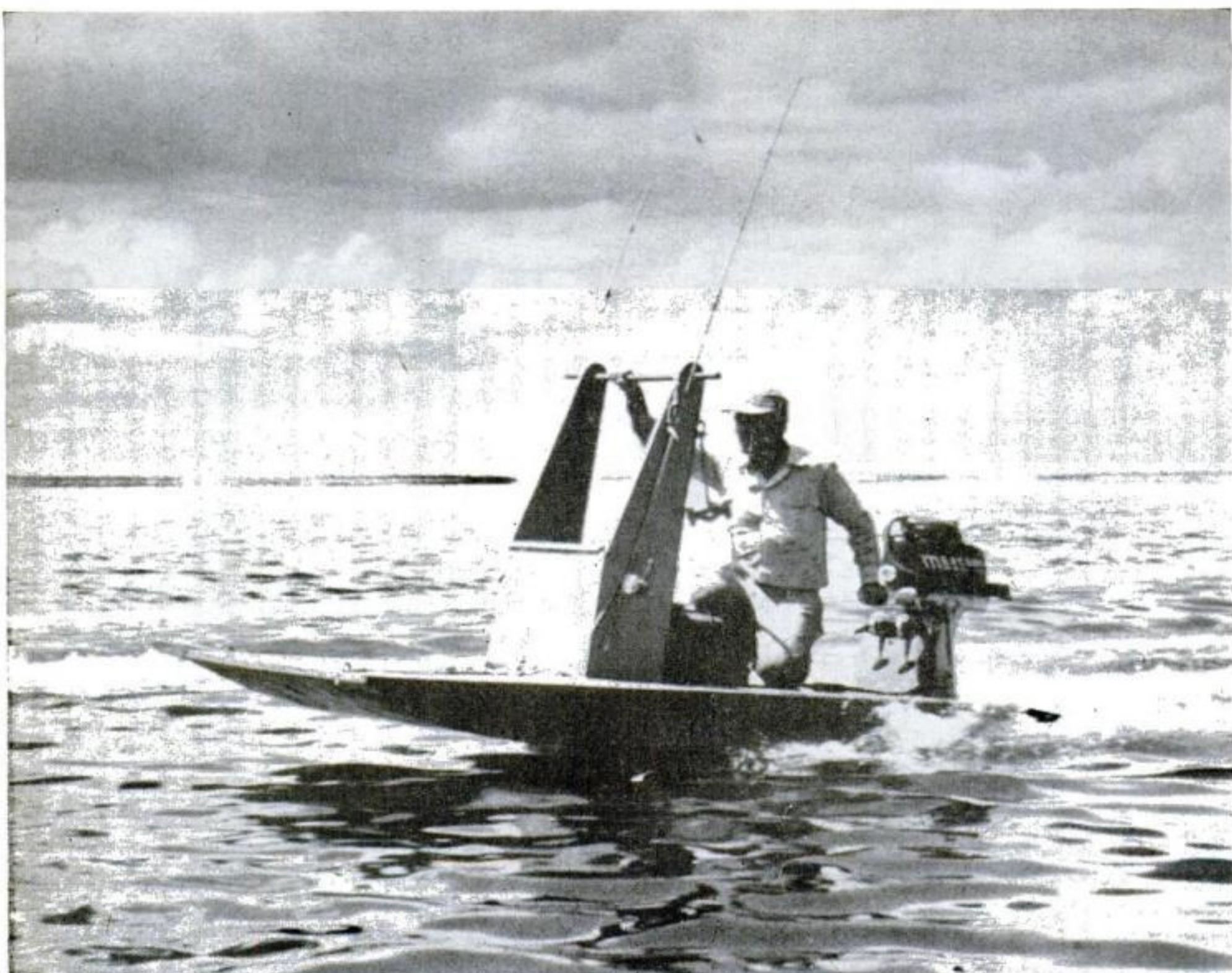




**To help you keep your balance.** Check-writing desks at this bank have built-in adding machines set flush with the tops so patrons can figure up check stubs quickly and correctly. The Burroughs installations, in a new Denver bank, are said to be almost noiseless in operation.

**Double silencer.** Each engine of this twin-jet British Super-marine Scimitar is fitted with a suppressor to cut noise during ground tuning. The new Royal Navy fighters take off in 30 seconds, climb at record rates and attain the speed of sound. They carry nuclear weapons.



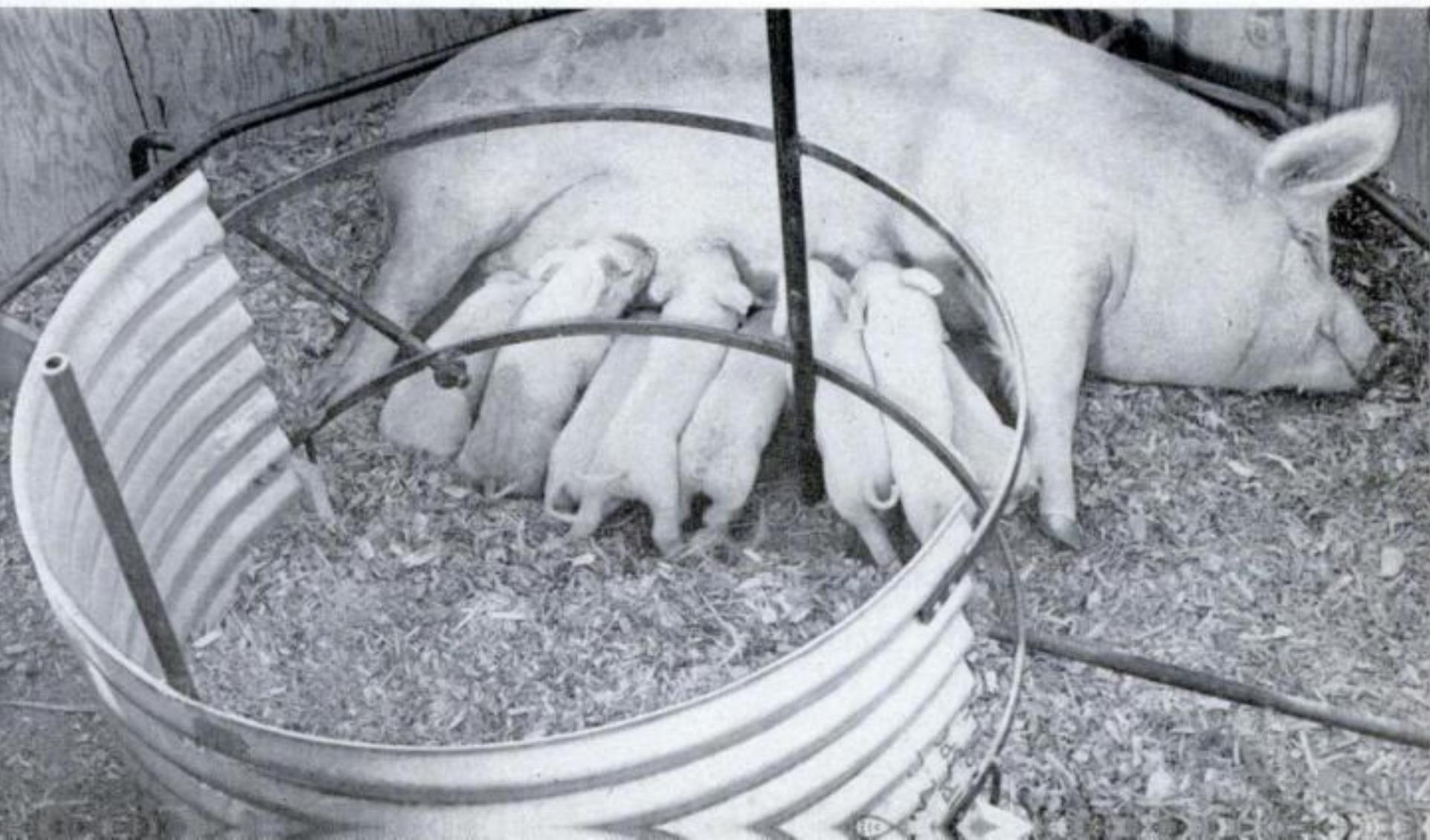


**Fishing scooter.** This "railroad handcar on an ironing board" helps a group of Texans to catch fish where nobody else can. An outboard motor on a scooter built by Joe Bob Lawrence of Harlingen and his fishing companions, it rides over flats into the shallows where fish are plentiful. It's made of plywood, has a fast planing surface and is steered simply by shifting weight. The deck box holds food and tackle.



**Lofty lookout.** Visitors to New York's International Airport can now enjoy a bird's-eye view of activities on the flying field from an observation deck on the 10th floor of the 11-story control tower. Enclosed with plate-glass windows commanding all directions, it's the highest in any airport in the world and the only one in a control tower.

**Chow time in a Pigloo.** These little piglets feed up in preparation for market—and in safety from being crushed by a big, fat mama—in this new circular house. Scientific design comes to their rescue to make the sow face the center during feeding, and an iron railing keeps the squeeze off unwary youngsters. Nutrena Mills, Minneapolis, calls it a Pigloo.



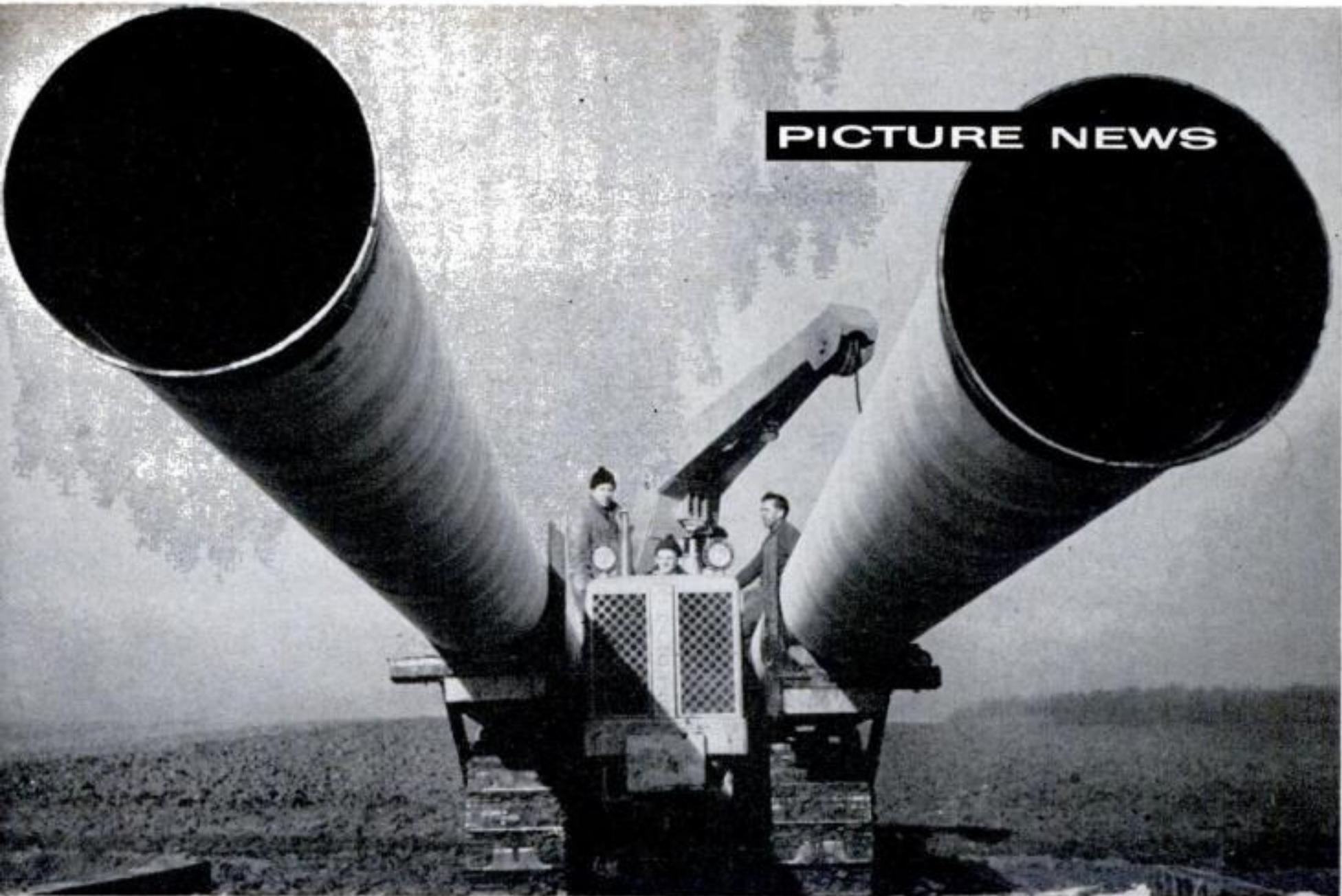


**Curbside telephone.** A new kind of phone for motorists has been installed at the curb on a Chicago street. It has the dial in the handset—around the mouthpiece at bottom—so that the driver can simply pull it to the side of the car in order to dial his number. The phone is mounted on a 4½-foot pedestal protected by a plastic hood and has a built-in light.

**Bulletproof "robot."** Put a man in this goggle-eyed science-fiction suit, and he can walk into a shotgun blast and barely feel it. It's fiber-glass and plastic, resists bullets like quarter-inch steel. Ports open for defense weapons, vision is through bulletproof glass and "eyes" are spotlights. Independent Engineering makes the suits for Detroit police.



PICTURE NEWS



**Twin-gun pipe carrier.** This handy machine, looking like something new in double-barreled atomic cannon, picks up heavy lengths of pipe from the ground, transports and gently unloads them in place. It and its built-in 3.2-ton crane are operated by a crew of three. Made in Hanover, it is here being used by a German water company to help lay a new pipeline.

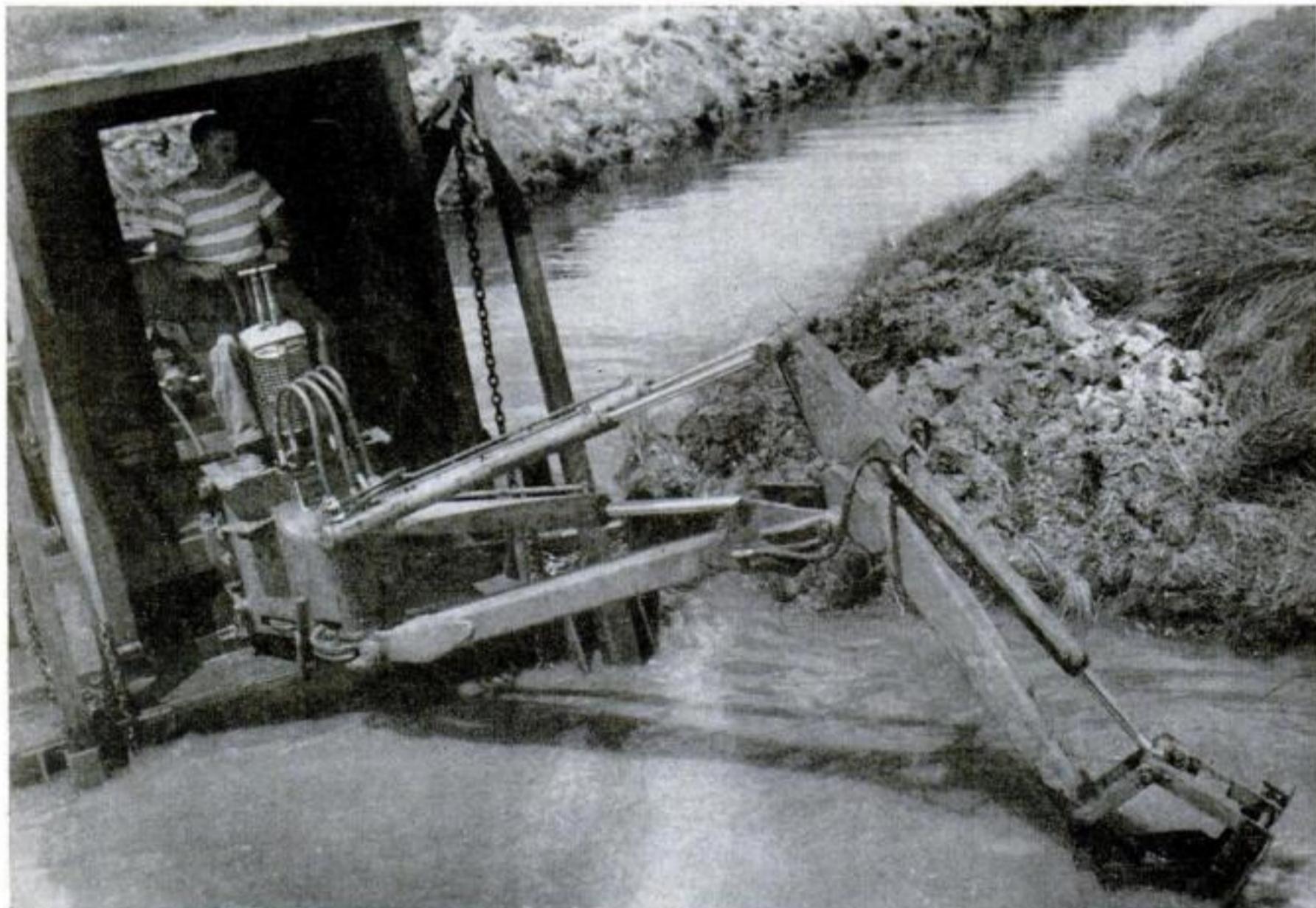
**Pinball navigator.** By studying the effect of table controls on an instrument panel, you can "blind-fly" a plane to a landing. The demonstrator simulates instrument landing, distance measurement, radar and direction finding. Shown here by CAA Assistant Administrator Ora W. Young, it will be seen at New York's International Aviation Show next month.



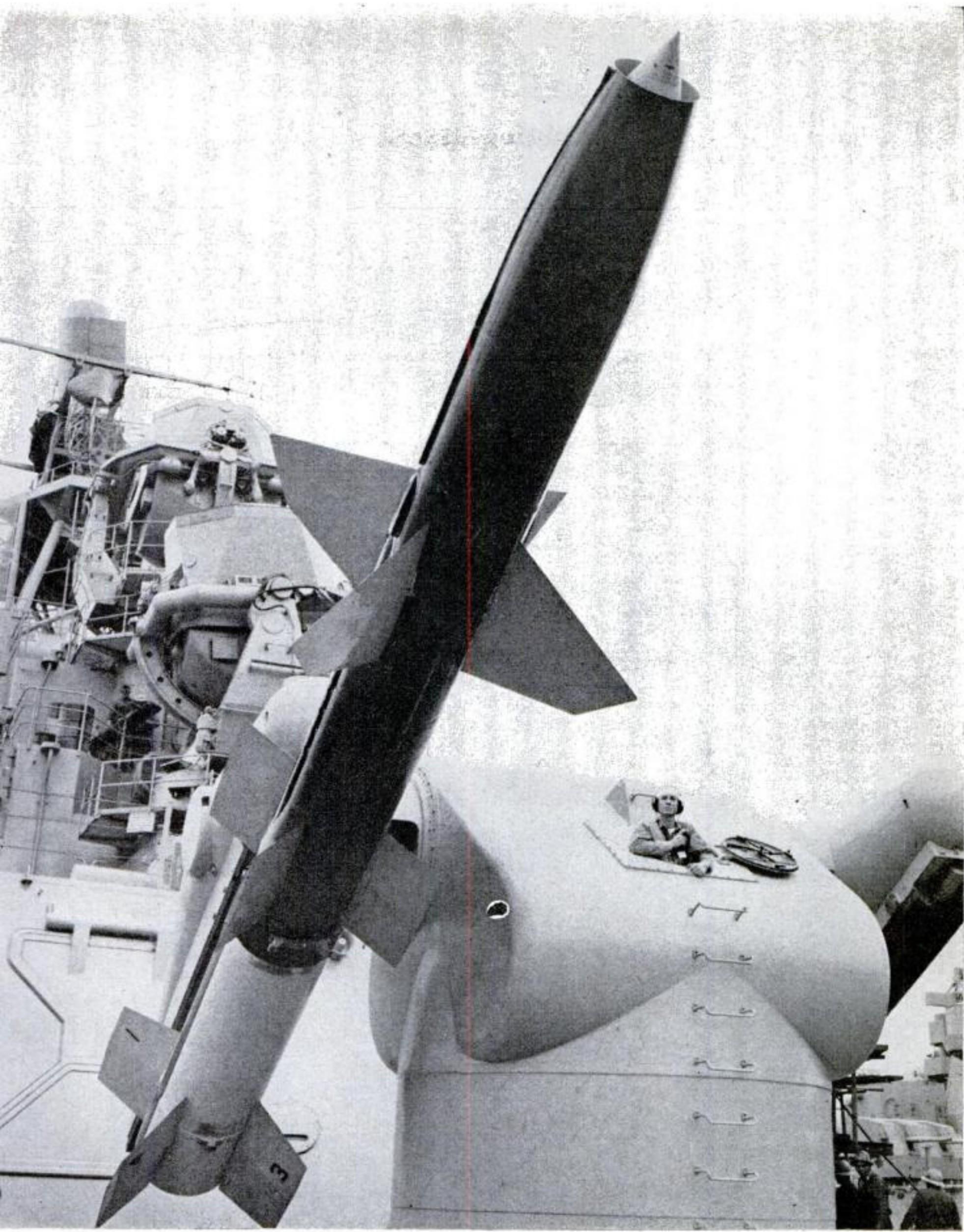
**PICTURE NEWS**



**Home plate that hears.** Arguments that go on at home plate can now be heard by fans of the Keokuk (Iowa) Kernels. The electrician above is installing a mike that picks up conversation for 30 feet around. With it the Class C team makes a baseball first. Control is from the press box.



**Smallest channel dredger.** With a ditch digger mounted on a home-made barge to make the pint-size dredge above, Linn Ferris built a marina for cottagers on a popular Lake Erie beach at Turkey Point, Ont. Using a Sherman power shovel built for Ford tractors, he dug a canal behind the summer homes and connected it to the water at one end.



**65-mile uppercut.** A supersonic Talos guided missile hangs from a launching turret aboard the USS Galveston, first of the long-range missile cruisers to join the fleet. The 3,000-pound ramjet Talos can destroy enemy aircraft 65 miles away, reaching into the stratosphere for its kill. Earlier cruiser-launched missiles have a 20-mile range.

# Our Strange Buying Habits at the Gas Station

**Psychologists find we buy premium gas to fuel our egos, not our engines, and use our cars to satisfy subconscious needs**

THE simple process of buying two-bucks-worth-of-gas-and-check-the-oil-please may actually be anything but simple beneath the surface. That's the verdict of a group of psychologists who have studied what happens when you drive into a service station. Sample findings:

- People often buy premium gasoline for illogical motives.
- After a grease job, a typical customer rarely frets over whether the right *kind* of grease was used; but he does worry over whether some of the grease fittings were skipped.
- Women come to gas stations in a state of "generalized anxiety," and tend to avoid stations where maneuvering skill

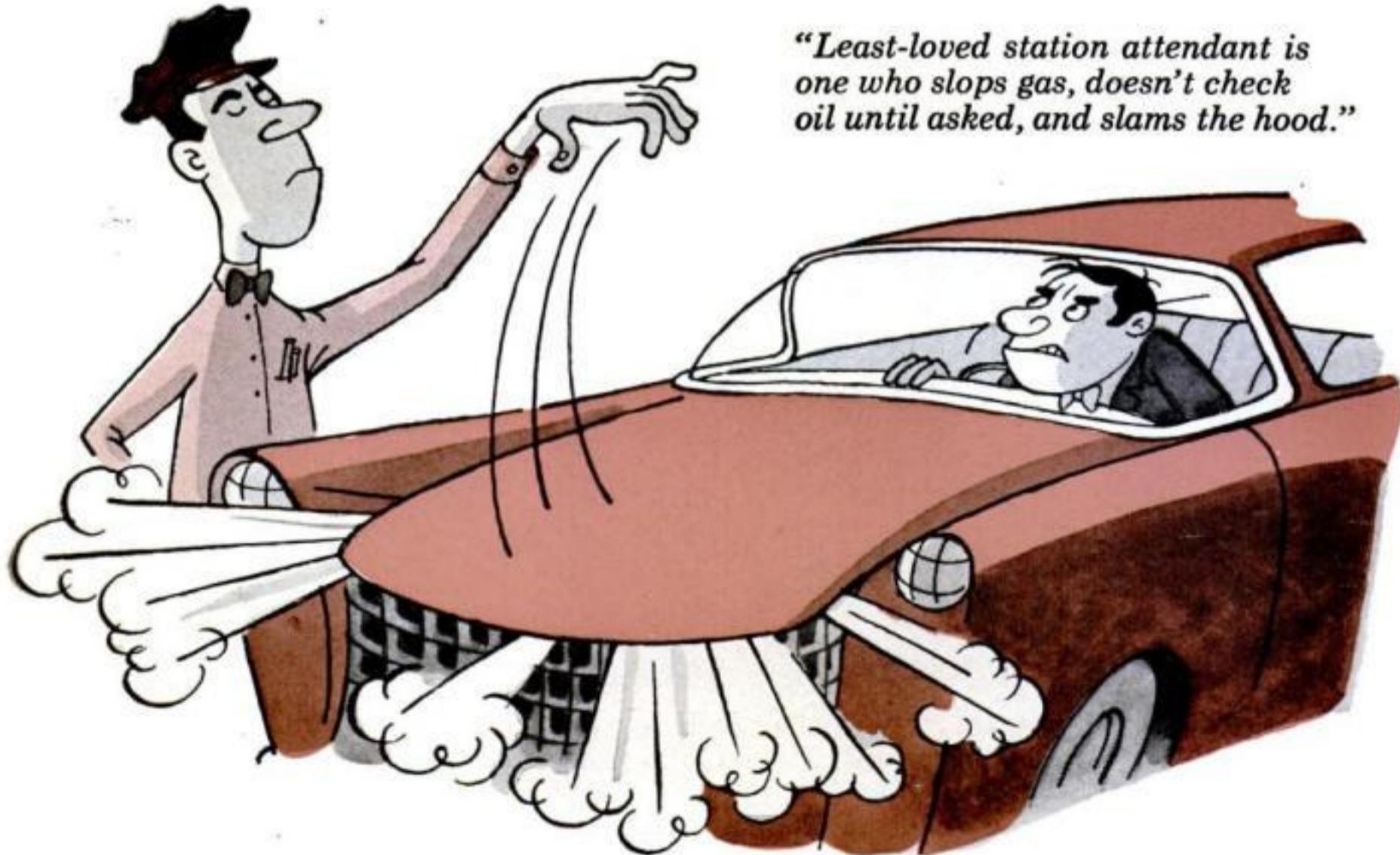
is needed to bring the car to the pumps.

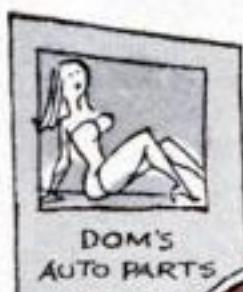
- Personality characteristics of the autoist may affect his purchases: An aggressive man may be a customer for new spark plugs, a meek one most easily sold a can of polish.

These provocative conclusions are embodied in a psychological study recently made for Du Pont called "Buying Patterns at Service Stations." Based on detailed interviews with several thousand motorists, it employed psychological and statistical techniques to seek out typical below-the-surface attitudes. Du Pont's objective in making the study was to help oil companies and suppliers improve gas-station marketing.

**Hidden hungers.** Why do you own a

*"Least-loved station attendant is one who slops gas, doesn't check oil until asked, and slams the hood."*





**GLEAMO  
POLISH**

**ZOOM**  
SPARK PLUGS



Ralph Steen

*"An aggressive driver may buy new plugs; the buyer of polish may want to avoid seeming inferior."*

car anyhow? The social scientists report that, apart from such logical, openly stated reasons as utility and convenience, car ownership may also serve to satisfy hidden (perhaps subconscious) hungers. They identify four of them:

1. *The play need.* Here the car serves for diversion and amusement, an "adult toy." Manifestations include Sunday rides, vacation trips, and driving simply for fun.

2. *The aggression need.* In this case a car is a means of "belittling another or

proving one's superiority." Examples include the man who tries to be first away from the traffic light, dislikes being passed, or prefers a V-8 to a six because it could help him in his efforts to dominate other drivers.

3. *The conservance need.* This is defined as a desire to "repair, clean and preserve things." Typical behavior here includes tinkering with the car, washing it frequently, and preoccupation with "protecting an investment."

4. *The "infavoidance" need.* This

*"For some drivers, the car satisfies the aggression need. Passing others, zooming away first from the light seem to prove superiority."*



## **Men want all-around service; women worry about tires**

coined word, combined from "inferiority" and "avoidance," describes a desire to escape humiliation or ridicule in the eyes of others. Here the car serves to (or is supposed to) keep others from concluding that you are a "person of inferior position, quality or taste."

How do these spooky needs affect products sold in a gas station? The psychologists say that they establish ways in which each commodity should be preferred to the customers. Thus grease is sold by strumming on conservance chords—it "helps to keep the car in good operating shape." The theme for spark plugs is aggression—good plugs are needed for top performance. And body polish is supposed to be sold on a note of "infavidence"—if a car has a gleaming finish, its owner is in less peril of being thought a shabby character.

**Gasoline paradoxes.** Du Pont points out that gasoline is something that cannot be inspected by its buyer—that it is rarely handled or even seen by the man who pays for it. "He has almost none of the usual ways of deciding about products . . . [except] 1) perceptions of how his car operates, and 2) the promotional message of the petroleum company."

This restricted chance for judgment may account for a strange conflict between belief and behavior. Three-fourths of the motorists studied believe that all major brands of gasoline are about the same. But very nearly three-fourths also tend to patronize a single company's service stations. Apparently a favorite gas station is chosen for other reasons than its fuel. Instead, the choice is based on such things as an agreeable guy at the pumps, or possession of a credit card, or neighborhood convenience, or especially good service.

Service, the psychologists found, is much more important than perceived differences in fuel. In composite traits, the worst possible gas-station attendant is the guy who is slow to come out, slops gas on the fender, lackadaisically smears the windshield, doesn't check the oil of his own accord, and, in a final gesture of unlovableness, allows the hood to fall with a resounding crash.

**Premium fuels the ego.** Although the brand of gasoline isn't important, the

grade is. Almost half of the motorists studied (48 percent) preferred premium grades; and the others were divided between those who bought regular gas and those who sometimes bought premium. Drivers in the south and west, and women everywhere, were most likely to buy premium grades.

The reasons given fascinated the researchers. Mostly they were reasons associated with power and performance. But a startling number of people claimed they bought premium because it gave them increased gas mileage. As the report dryly pointed out, "It would be necessary to get a great increase in mileage to justify the difference in price . . . The motorist does not seek to save money but to bolster his ego."

**Wanted: a deal.** When buying tires, batteries and antifreeze, some motorists display a pronounced tendency to shop elsewhere than at gas stations—at specialty stores, mail-order houses, and the like. Prying into motivations, the psychologists unearthed a sheaf of rationalizing explanations, including better selection, lower prices, higher trade-in allowances, fresher stock, or simpler credit arrangements. While not necessarily attacking the validity of these reasons, the psychologists felt they did not go deep enough. "One of the primary motivations [is] the desire to make a 'deal' . . . in order to express feelings of superiority and achievement, and to win recognition—something to boast about."

On the basis of this study, women have a miserable time in gas stations. They usually go to a particular station because their husbands have told them to, and while there are in a "state of generalized anxiety." They are more concerned about the cleanliness of the rest room than the needs of the car, which are a troubling mystery.

Women often worry about the tires, though, because one of their biggest motoring fears is having to change a flat on the road. To them the ideal gas station is one where the pumps can be reached without difficulty, where the rest room is immaculate, and where a competent attendant tells—not asks—their what he should do to take care of the car's strange needs.

END



Lake Chelan, Wash.: Miss Bardahl roars into turn bow-and-bow with Maverick. Miss B. won.

**America's top designer of hydroplanes tells—**

# **What Puts the Speed in a Champion Speedboat**

**By Elliot Marple**



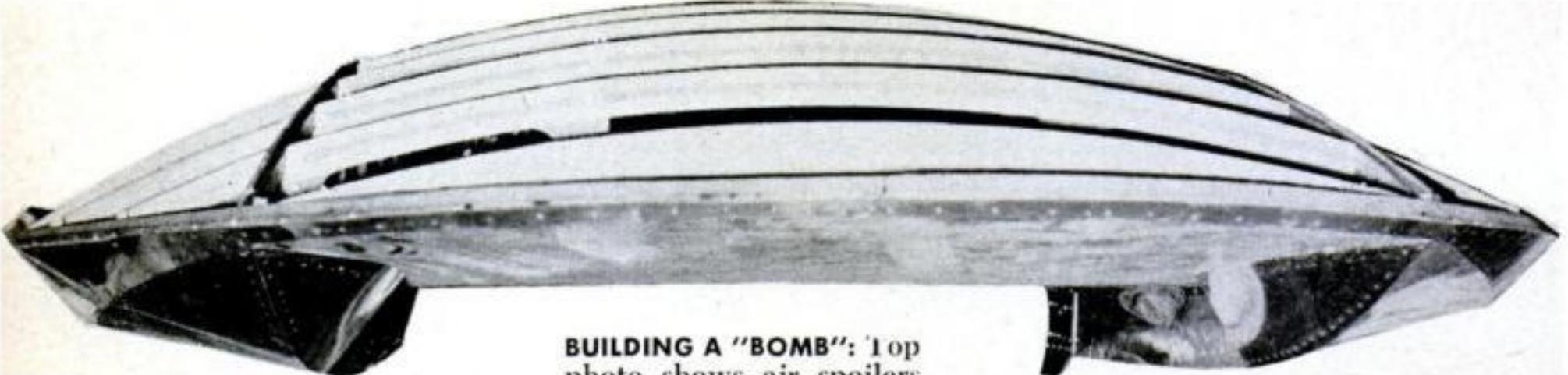
*Designer Ted Jones—he's setting a fast pace in the boat-racing circuit.*

**W**HAT makes a champion hydroplane?" I asked Ted Jones, greatest designer of speedboats in America. "Obviously it's not just design or power."

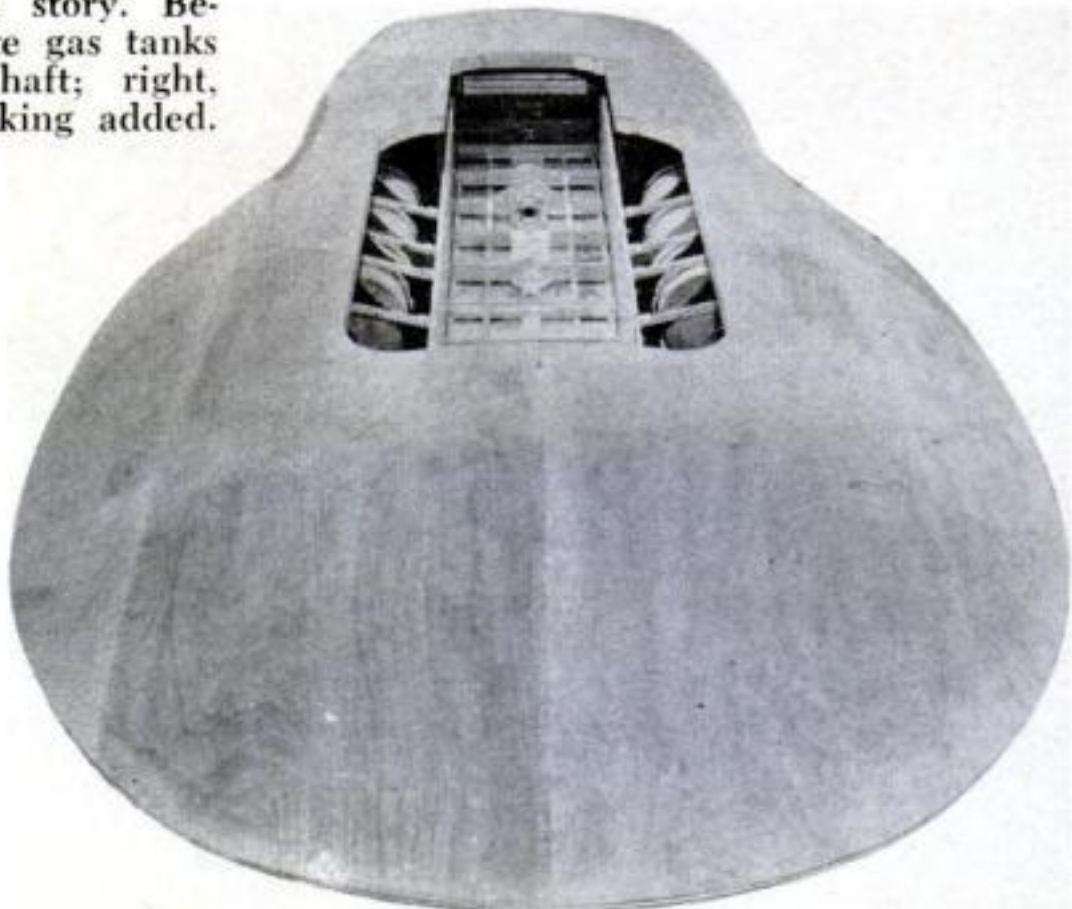
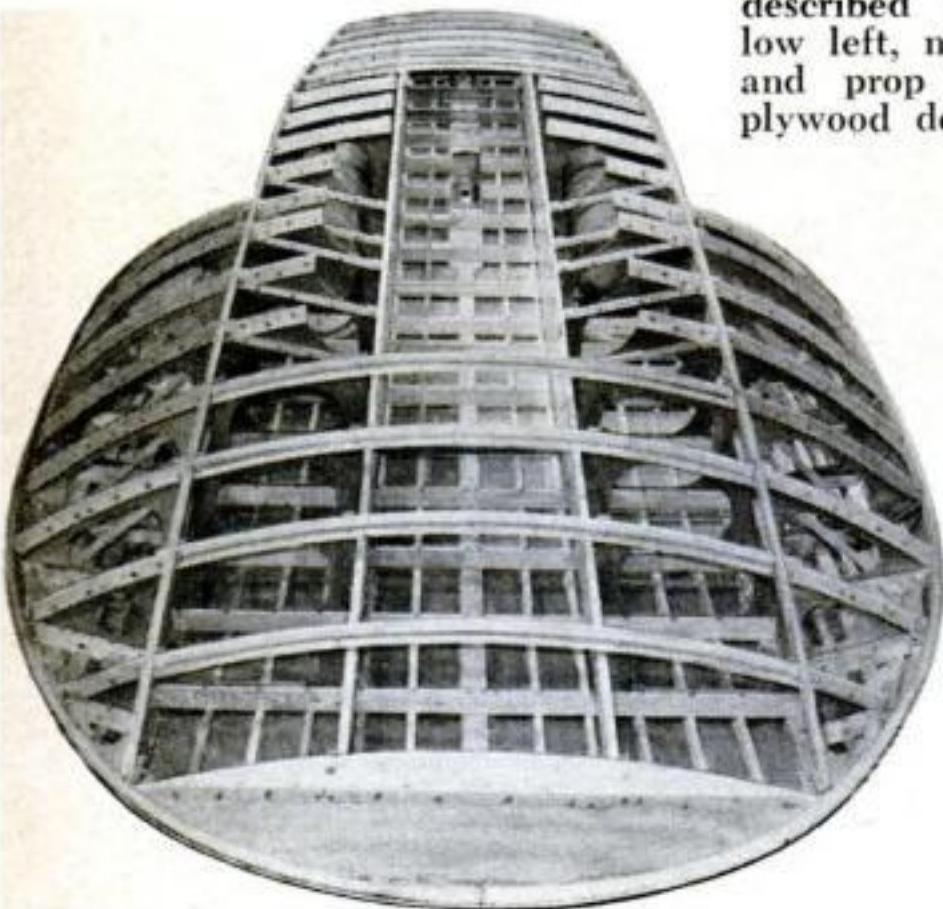
"You might say," Jones answered, "that it's all the little things your competitor overlooked." Turning away from his newest hydro, Miss Bardahl, which he was readying for the 1958 racing season for unlimited hydroplanes, he explained:

"Design counts, and power, and they've got to be in the right combination. But little things can be vital, too—the shape, size and location of the rudder; the size of the propeller with respect to gear ratio; the location of the prop; the size and shape of that tiny skid fin; the construction of fuel tanks, and even the driver's seat."

Jones pointed to the narrow-backed padded seat in Miss Bardahl. Norm Evans, the driver, is an ex-welterweight boxer. His



**BUILDING A "BOMB":** Top photo shows air spoilers described in story. Below left, note gas tanks and prop shaft; right, plywood decking added.



hips are slim, and the seat was tailored to his fit. Padded armrests are built in close to the body, then undercut to leave room for his thighs. "If the pilot is held snugly he can do better than if he's tossing around," Jones explained.

"Individually," he went on, "details don't amount to much, but collectively they can lose you a race. Take the fuel tanks, for instance."

**Tanks are welded aluminum** wrapped with reinforced fiber-glass in Jones' boats. If a crack appears, a little resin and glass cloth will permit repairs between heats.

"When you go into a turn at 140 m.p.h., fuel is thrown high up against one wall in the tank," Jones said. "That leaves a void and the fuel line draws air. As a result you backfire and slow down, or even blow part of the engine off. To prevent this, we have a partition that traps some gas over the fuel opening."

The water pickup, too, must be just right to ensure proper engine cooling, whatever the speed of the boat. Miss Bardahl's cooling system is designed for a

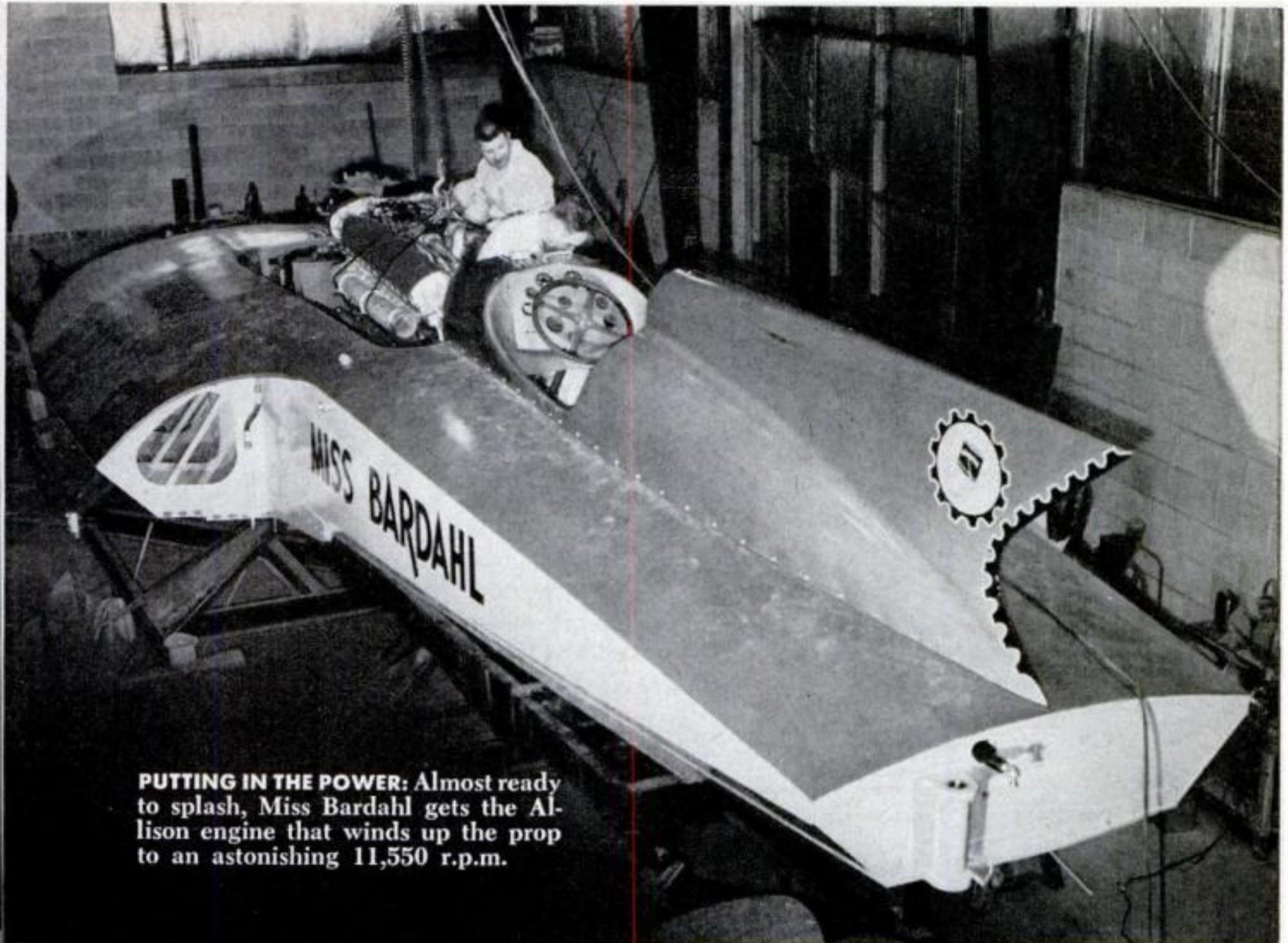
constant water pressure of 25 p.s.i. At higher speeds, when the pickup pressure is much greater, a spring-loaded relief valve opens, keeping pressure constant.

Because he has come so far in hydroplane design in the last dozen years, Jones can afford to concentrate on the little things. His first unlimited, Slo-Mo-Shun IV, went into racing in 1950 and revolutionized hydroplane design.

**In the years just before Slo-Mo,** the best heats in Gold Cup races generally ranged between 52 and 70 m.p.h. Last year's Gold Cup saw speeds almost twice as great. And every boat in it was either a Jones design or an obvious copy.

The new Miss Bardahl, the second unlimited that Jones has designed and built, has a number of innovations meant to eliminate faults in earlier racing craft.

An example is the air spoilers, which Jones introduced in the original Slo-Mo. A hydroplane travels as fast as the far heavier DC-3 airplane; the DC-3 takes off, the hydroplane must not. The hydro rides on a wedge of air that flows between



**PUTTING IN THE POWER:** Almost ready to splash, Miss Bardahl gets the Allison engine that winds up the prop to an astonishing 11,550 r.p.m.

the water and the hull and is trapped on the sides by the vertical edges of the sponsons. But the lift from this wedge of air must be no greater than hull weight.

Jones borrowed from the aircraft industry the idea of a spoiler that would break the flow of air under the hull and reduce lift as the bow rose. The spoiler also prevents "nosing in" in rough water.

In Miss Bardahl, Jones has made a strategic shift in the location of the spoiler. In place of a single central spoiler he attached two smaller ones right to the sponsons. Why?

"Last year, racing at Madison, Ind., Miss Thriftway hit a swell from a cruiser, went up in the air, and came down at an angle on her nose. The force of water caught the dihedral of one sponson and tore the boat apart diagonally. Now we've built the spoiler into each sponson, giving the sponson a V bottom, so when she hits a turn at excessive speed the water won't catch and rip it off."

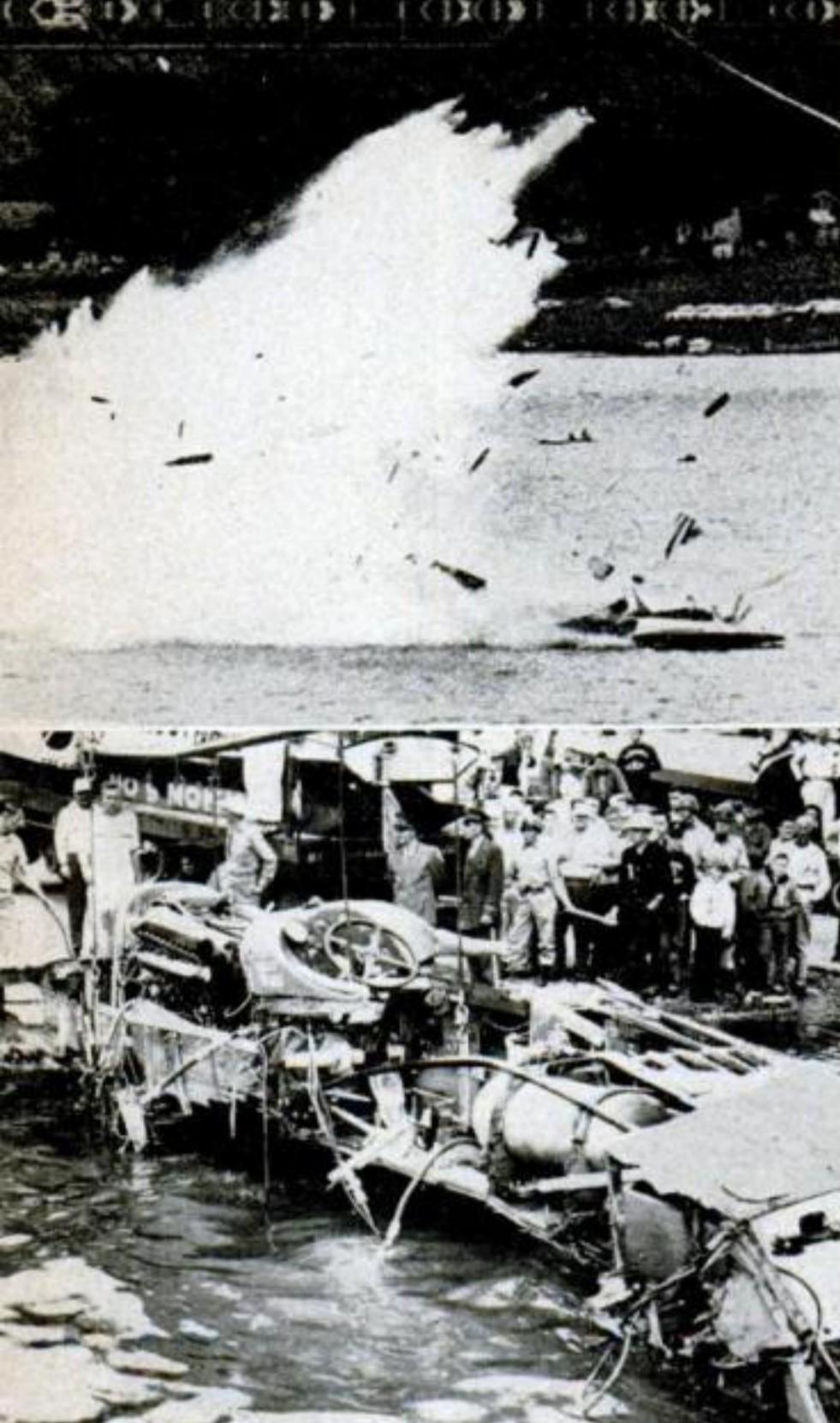
On Miss Bardahl, Jones also tapered the forward deck to a thin edge where it

joins the hull at the very bow of the boat. Three layers of fiber-glass cloth have been laminated around the edge for greater strength with very little increase in weight. Why was it added? Again Jones points to a failure in an earlier racer:

"In the 1956 Gold Cup race at Detroit, Bill Muncey, driving Miss Thriftway, struck a vertical wall of water near the Belle Isle Bridge. The water got in between deck and hull and instantly lifted off 12 feet of the deck."

**The forces involved** when a hydroplane tears over the water at 150 to 180 m.p.h. are tremendous. At that speed, "the force of a sheet of water is like a giant knife," says Jones. "It rips, tears, and cuts. The faster you go, the sharper the knife. When Miss Thriftway had her accident, the water tore 3/16-inch duralumin like tissue paper—metal so strong that we couldn't straighten it out with a hammer. This edging keeps the water out."

Another innovation in Miss Bardahl is the plastic fin or tail of molded fiber-glass and polyester resin. The tail was intro-



**HIGH-SPEED CRACKUP** last year at Madison, Ind., ripped hull off Miss Thriftway. Nose dive after hitting a swell at 165 m.p.h. did it. Driver, thrown clear of wreckage (above), survived.

duced to hydroplane racing in Slo-Mo IV to help the driver hold his course at high speeds and offset the side thrust of the prop. But until this year's Miss Bardahl, the fin required outside struts for its support, a constant hazard to the driver. If he is thrown out and strikes a strut, he might be cut in two. The plastic fin, with internal supports, eliminates that hazard and gives the boat cleaner lines.

**For better control on the turns,** Miss Bardahl has a larger, longer non-tripping chine. This is the 45-degree angle along the side of the hull, starting narrow just aft of a sponson and widening as it extends to the stern. The non-tripping chine—called the “non-trip”—comes into play mainly in rough water. When a hydro takes a fast turn, it rides the chine.

Up to now a driver starting a turn at 120 m.p.h. would come out doing 80 m.p.h. But better lateral support from the

larger chine should enable him to start at as much as 155 and come out at 110.

Extra strength has been built into Miss Bardahl in many places, frequently with a saving in weight through use of duralumin. In a number of places dural is bonded to plywood. The sponsons and non-trip chines, formerly planked with plywood, now have  $\frac{1}{8}$ -inch dural.

Use of aluminum-plywood laminate cuts about 500 pounds from the weight of the boat, holding its total weight without engines close to 3,000 pounds and making for faster acceleration.

The construction of Miss Bardahl borrows more from the aircraft industry than from marine design. “There is not one piece of marine equipment in the boat,” Jones observes. Aircraft bolts are used more and more in place of screws. The propeller is not bronze, but a heat-treated steel forging 25 times as strong as the prop of a pleasure cruiser.

The special props cost \$625 each, and an unlimited hydro should have six as a minimum—two sets of three different pitches. The prop used will vary with the condition of the water and altitude. (High altitude calls for less prop pitch.)

**Unlimiteds don't come cheap.** The initial cost is approximately \$30,000, and that's just a starter. If Miss Bardahl blows four or five engines and a couple of gearboxes, the preseason ante goes up fast. The sponsor, Bardahl Manufacturing Corp., Seattle, also carries on its year-round payroll Norman Evans, driver; Del Gould, crew chief; and Rudie Boppel, lead engine man.

For Ted Jones this is a year when, more than ever, he appears to be racing against himself in the Gold Cup. The new Miss Thriftway, slightly larger and heavier than Miss Bardahl, is another hydroplane off the Jones drafting board, and Jones is manager of two Thriftway boats in the 1958 racing circuit. Other, older boats of Jones' design are out competing for honors, too.

Tall, high-strung, and with a trace of gray showing in his black hair, Jones has lived and breathed boat racing for most of his 48 years. As a hobby, he started to design and race limited hydroplanes in 1927. Working at Boeing Airplane, he saw what lessons aerodynamics had to teach in speedboat design.

[Continued on page 200]

# When Is the Smart Time to Trade In a Car?

**Here's the scientific low-down on how you can cut the cost of owning a car by knowing just how long to hang on to it**

**By David R. Lindsay**

EVER since Henry Ford mass-produced the Tin Lizzie, it's been possible to start a lively argument around any gas pump by asking when a man should swap in his automobile. The question is loaded with such intangibles as prestige, sentiment, pride of ownership and the yen for something new. But it hits a realistic wallop on that sensitive nerve, the pocketbook.

Now a Chicago research engineer and an M.I.T. computer mathematician can give you the scientific low-down on that old argument. Working independently, they have come up with much the same surprising answers. Here they are in a nutshell:

- Trading every year is an expensive hobby. Unless you must have the latest model for prestige or can afford it just for fun, don't.
- Turning your car in only when it is a near-antique is also expensive. Unless you have outstanding mechanical savvy and the time to use it in making your own repairs, trade earlier.
- The great group of average drivers who rate reliability a little above econ-

omy should buy a *new* car—and run it no more than 45,000 miles or four years if it's a Ford, Chevrolet or Plymouth; 60,000 miles or five years if it's a bigger car.

- If you rate economy above reliability, buy a *used* car, *three years old*, and run it no more than three to four years.
- Think about trading any time your car needs work with a three-figure price tag on it.

*Why buy another*, many an owner asks, when mine is still basically sound? Barring accidents, isn't the cost of repairs always less than that of a new car?

That's true, say R. E. Runzheimer (the Chicago engineer) and Ronald T. Howard (the mathematician). But it's also dangerously short-sighted. Car ownership is continuous for most people, they point out, but individual cars don't last forever. Sooner or later, every vehicle must be replaced.

The longer you wait, the more you will eventually have to pay. Furthermore, the older a car gets, the more doctoring it requires. As age creeps up on your car, so do the repair bills and the cost of trading it in. The only sound way to plot the dollar-and-cents angle is to average all ex-

## **Here's what the wise money does**

SOME 200 corporations that employ modern cost-accounting methods depend on Runzheimer and Co. for advice on operating and trading their cars. Runzheimer tells his commercial clients to trade at the same mileage figures as he recommends for private owners. But he gives fleet operators lower *age* cut-off points: two to three years for Fords, Chevies and Plymouths, four years for more expensive cars.

A survey made recently by Dartnell Corp., management consultants, shows that nearly three-quarters of the companies replying traded their cars before they were four years old or had 60,000 miles. General Foods Corp. recently switched from a 25,000-mile, two-year to a 50,000-mile three-year trade policy. Johnston Testers, Inc., backed off from a 100,000-mile cut-off point to one of 60,000 miles or three years.

## **Under certain conditions, it would pay the owner of a**

penses, no matter what year they fall in.

**Beat the system**, says another school of gas-pump debaters, by trading your car every second year. That way you avoid both the high depreciation loss of the one-year trader and the high repair and replacement cost (as well as the old-car dowdiness) of the long-term owner.

This is fairly close to the truth, both Runzheimer and Howard would agree. But it goes astray in underestimating the economically useful life of the modern automobile.

Today's Detroit product is engineered to run for 100,000 miles and often does, working eight to 10 years for several owners. From the experience of his clients' fleets (totaling 20,000 passenger cars) Runzheimer has learned that the Chevrolet-Ford-Plymouth class is fairly trouble-free for the first 45,000 miles, heavier cars for the first 60,000.

This is the basis for Howard's recommendation of a used car as top transportation value. By buying a three-year-old, you get a car on which somebody else has taken the big depreciation but on which there may yet be many trouble-free miles of travel.

Not a car expert to begin with, Howard became interested in auto trading while in search of questions to ask a new electronic brain. Using both Runzheimer's data and some of his own, Howard asked the giant computer what ownership plan would be the best bargain for the average driver. Besides recommending a used car,

the brain came up with the surprising fact that, on a hard-headed economy basis, it would pay the owner of a new car to sell it at once and buy a three-year-old model instead!

This advice assumes that the average car owner logs 10,000 to 12,000 miles a year. (Salesmen average 19,500 and many exceed 30,000.) If you are a high-mileage man, used cars are not for you. They haven't enough trouble-free life left in them to be worth your while. High-mileage drivers should buy a new car and trade it a year to a year and a half earlier than other drivers.

**Do you swear by some make?** Then you probably wonder how the experts can lump all Detroit's buggies into only two major groups. The answer is that a valid analysis must be based on a big sampling. Runzheimer has been collecting his evidence for 25 years. Though there may be differences among makes, there are also variations from year to year in the same family of car. In the long run such differences average out. As yet Runzheimer hasn't enough evidence to differentiate between makes. (Some experts, however, would put both the Rambler and the Studebaker Scotsman in a separate class, to be traded somewhat sooner than cars in the Big Three group.)

From your knowledge of your own car, you may be warranted in biasing the rules for that make. In this you have an advantage over fleet operators, to whom any specific car is just a line on a record sheet. Knowing all about your own wagon, you can make an educated guess as to its future and the odds on major repairs.

**The age and mileage limits** given are intended to spare you these, leaving you a minimum of repairs and replacements to pay for. A first-line set of five tires, used on good roads and properly rotated, should run 24,000 to 30,000 miles on a sedan. Most 45,000-mile traders should therefore get by on one replacement set. If you put only 5,000 to 7,000 miles a year on a car, you probably ought to trade before buying new rubber.

Brake linings usually wear out before 30,000 miles, sometimes around 20,000. With fairly flat driving country and a conservative right foot, you should have

*[Continued on page 202]*

### **Uncle Sam: world's biggest car operator**

THE U.S. Government at last count owned some 38,000 passenger vehicles, not counting station wagons (which are grouped with ambulances and buses). As this is written, the Government's trade-in policy is to dispose of cars at six years or 60,000 miles, whichever comes first. But there are reports that the cut-off point may be changed to three years or 50,000 miles.

Regardless of plan, however, the inventory showed that the Government had 297 cars 10 or more years old and 367 that had traveled at least 100,000 miles, a testimony to the long service life of the Detroit product.

## **new car to sell it at once and buy a three-year-old model**

### **What happens to your car's value**

THE figures below, sad but true, show what it costs you to own a car even if you never drive it. They are based on 1952 models, the values for the seventh year and beyond being estimated on the basis of a 10-year life and one-percent scrap value.

The first row shows percentage of depreciation (on the original price) in each

year; the second row shows the equivalent in dollars. The third row totals depreciation to date, and the last is the per-year average obtained by dividing the total depreciation by the age of the car.

This last row is what the loss of value costs you per year if you trade then. To it must be added the yearly average cost of replacements and repairs.

FORD-CHEVROLET-PLYMOUTH CLASS (delivered price \$2,500)										
YEAR	1	2	3	4	5	6	7	8	9	10
% Depreciation	32%	13%	10%	9%	9%	8%	7%	5%	4%	2%
\$ Depreciation	\$800	\$325	\$250	\$225	\$225	\$200	\$175	\$125	\$100	\$50
Cumulative depreciation	\$800	\$1,125	\$1,375	\$1,600	\$1,825	\$2,025	\$2,200	\$2,325	\$2,425	\$2,475
Average dep. per year	\$800	\$563	\$458	\$400	\$365	\$338	\$314	\$291	\$269	\$248
PONTIAC (delivered price \$2,800)										
YEAR	1	2	3	4	5	6	7	8	9	10
% Depreciation	29%	16%	11%	10%	9%	8%	6%	5%	3%	2%
\$ Depreciation	\$812	\$448	\$308	\$280	\$252	\$224	\$168	\$140	\$84	\$56
Cumulative depreciation	\$812	\$1,260	\$1,568	\$1,848	\$2,100	\$2,324	\$2,492	\$2,632	\$2,716	\$2,772
Average dep. per year	\$812	\$630	\$523	\$462	\$420	\$387	\$356	\$329	\$302	\$277
CADILLAC (delivered price \$5,000)										
YEAR	1	2	3	4	5	6	7	8	9	10
% Depreciation	22%	12%	16%	11%	9%	8%	7%	6%	5%	3%
\$ Depreciation	\$1,100	\$600	\$800	\$550	\$450	\$400	\$350	\$300	\$250	\$150
Cumulative depreciation	\$1,100	\$1,700	\$2,500	\$3,050	\$3,500	\$3,900	\$4,250	\$4,550	\$4,800	\$4,950
Average dep. per year	\$1,100	\$850	\$833	\$763	\$700	\$650	\$607	\$569	\$533	\$495

### **Figuring your best trade-in year**

BY KEEPING good records of your repair costs and taking depreciation from the chart above, you can calculate when it will pay you to trade in your car. Divide the total cost of all repairs since you got the car by the number of years you've had it; add the result to average depreciation figured to the current year, and you have the cost of ownership per year

to date. This should drop for the first four to five years; when it starts to climb, you've passed the point of most economical car ownership.

The following figures on the author's 1951 Plymouth (delivery price about \$2,500) show how it was mistakenly operated beyond the best trade-in time.

YEAR	1st (1952)	2nd (1953)	3rd (1954)	4th (1955)	5th (1956)	6th (1957)	7th (1958)
Actual repairs	—	\$60	\$112	\$175	\$113	\$386	\$100+
Total repairs to date	—	\$60	\$172	\$347	\$460	\$846	?
Cost of depreciation per year (at given car age)	\$800	\$563	\$458	\$400	\$365	\$338	\$314
Cost of ownership per year (including repairs)	\$800	\$593	\$515	\$487	\$457	\$479	?

The sensible time to trade would have been in the fifth year, before \$386 worth of repairs became necessary. (This owner was fortunate; according to fleet records, many cars would have needed such repairs earlier, warranting a four-year trade.)

The seventh year is still incomplete, but barring the miracle that repairs will cost no more than \$150 (they are already over \$100) trading this late will cost more than doing so in the fifth year—a poor return for driving an old car so long.

# New Ideas from the Inventors



## 1 Outboard Rides Rails on Car Top.

You wouldn't have to stretch or struggle to clamp your outboard to the sliding board of this newly patented carrier. The

motor would ride horizontally, but a pivoting arrangement would enable you to hook the board on vertically, and slide it on or off from the side of the car.

## 2 Pistol Lock Prevents Accidents.

Tragic mishaps that occur when guns fall into the wrong hands might be prevented by a trigger lock like this. Designed to fit most firearms, it would block the space between the trigger and the guard until removed with the right key.

## 3 Hook Spares Undersize Fish.

You could throw a small fish back without mutilating it first (and free any fish more easily) if your hook had a pivoted arm like this behind the regular barb. A push and a pull would move the arm to cover the barb and make the withdrawal easier.



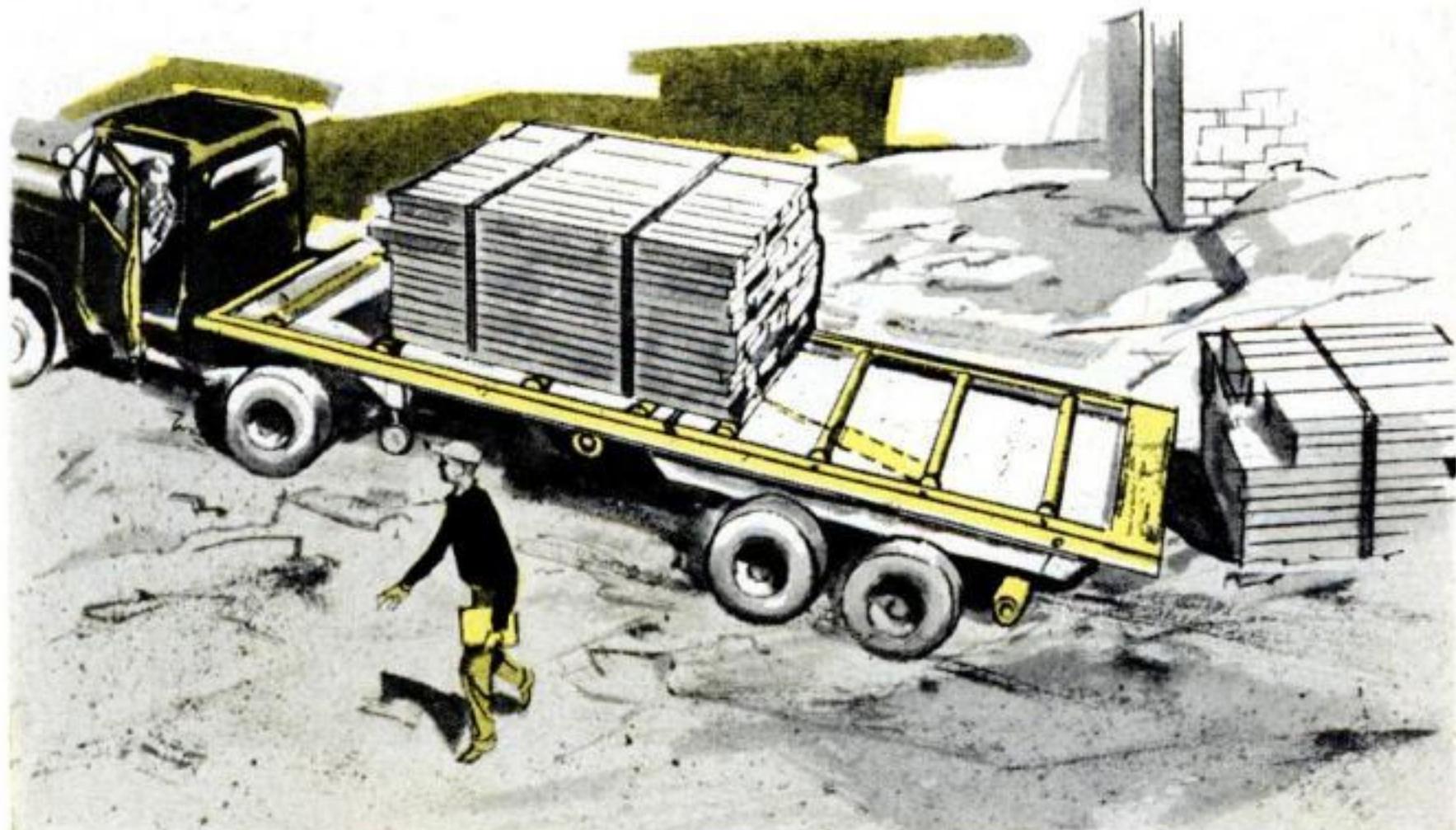


**4 Service Signal Keeps Driver Dry.** With an ordering panel like this near the filler cap, you'd have less need to open your window on a wet or cold day. Electrically operated from inside, the pointer would tell an attendant how much gas you wanted and whether to check the oil.

**6 Truck Shifts and Dumps Load.** Flat cargo could be readily shifted over rollers like these, built into a truck or trailer bed. For easier unloading, the long

**5 Golf Bag Doubles as Seat.** While waiting for your partner—or the party ahead—to play off, you could take a load off your feet with this golf-bag strap-seat. For carrying, the hinged leg would fold against the bag. For separate use, the seat could be removed from the bag.

bed would be sectioned. A hydraulic lift mechanism would tilt the rear section, so that after cargo was moved into position it could ride down the rollers.



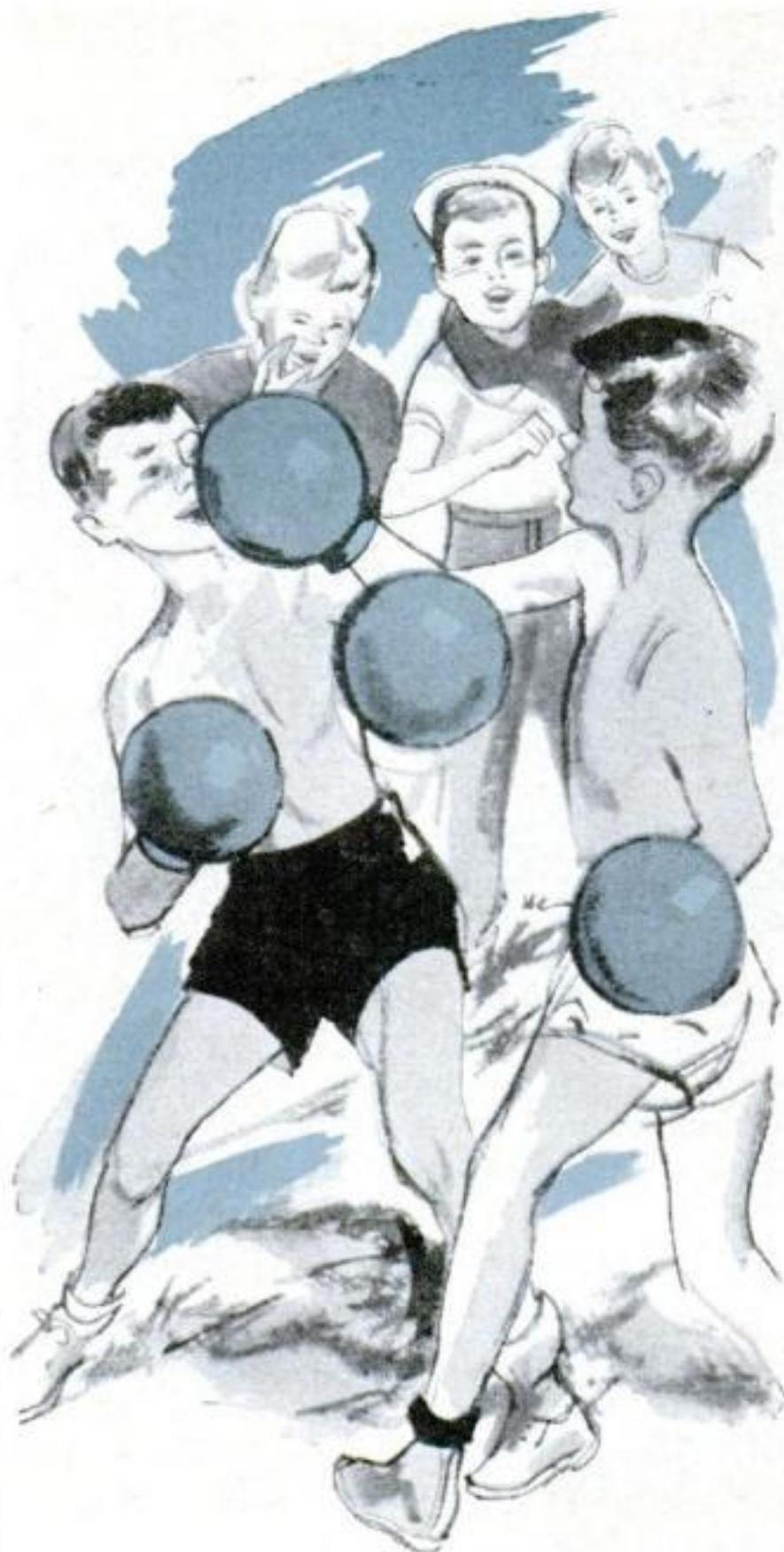
Please turn the page for more new ideas

AUGUST 1958 |||



**7 Wrapper Cooks Canned Goods.** You wouldn't need to build a fire to enjoy warm food on a camping or fishing trip if you carried foil wrappers like these. Chemicals sandwiched between foil strips would give off heat when wet. You'd just wrap a can in foil, dunk and serve.

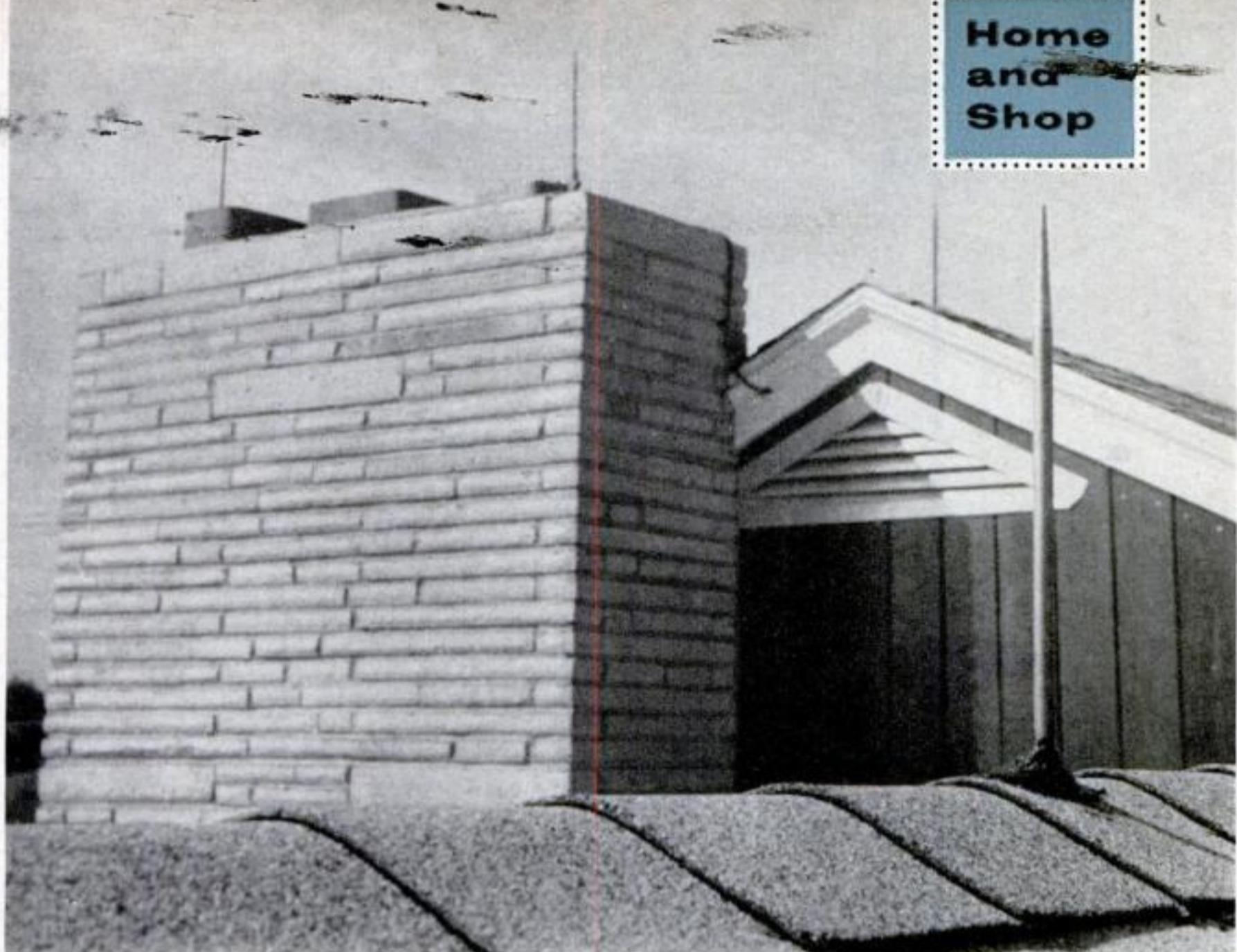
**8 Glasses Adjust for Brightness.** Polarized, double-lensed specs, says this inventor, would give you the same comfort under any degree of glare. Each eyepiece would have a fixed and a rotatable lens; a lever would turn the movable pair in unison. Changing the angle of polarization between the lenses of each set would vary the amount of light transmitted.



**9 Inflated Gloves Soften Blows.** Using these practice gloves, kids could throw real punches or swat each other with creampuff taps. Basically a balloon built around a fist pocket, each glove could be inflated to the desired firmness. For young apprentice boxers, they'd have the extra advantage of being light in weight.

The following patents have been issued on these inventions:  
 1. Patent No. 2,746,627 to W. W. White, De Queen, Ark.;  
 2. No. 2,505,227 to J. P. Charters, Flushing, N. Y.; 3. No. 2,816,392 to C. Goldberg and M. Goldhaft, Brooklyn, N. Y.;  
 4. No. 2,814,797 to H. A. Paulsen, Zumbrota, Minn.; 5. No. 2,736,357 to H. O. Stamp, Milwaukee; 6. No. 2,741,383 to J. T. Leckert, Hyattsville, Md.; 7. No. 2,814,288 to E. H. Reik, Cincinnati; 8. No. 2,813,459 to C. Archambault, Montreal, Que.;  
 9. No. 2,817,088 to Charles Vrana, Paterson, N. J.

Copies of patents may be ordered, by number, from the Commissioner of Patents, Washington 25, D.C., at 25 cents each. To write to an inventor, if the address given above is insufficient, you may address him (by name and patent number) in care of the Commissioner of Patents.



# Why Lightning Rods Are a Good Thing

By David X. Manners

DURING the years when sharp operators were busy selling the Brooklyn Bridge to guileless investors, other fast-dollar merchants in the hinterlands were cleaning up even more peddling lightning rods. Known as "state-liners," they were usually beyond the reach of local law by the time their victims discovered that the rods were made of wood, or that so-called metal cables actually were rope dipped in metallic paint.

America's first electrical appliance has yet to live down the shame. In many minds "rod" and "fraud" still go together naturally. But what are the facts?

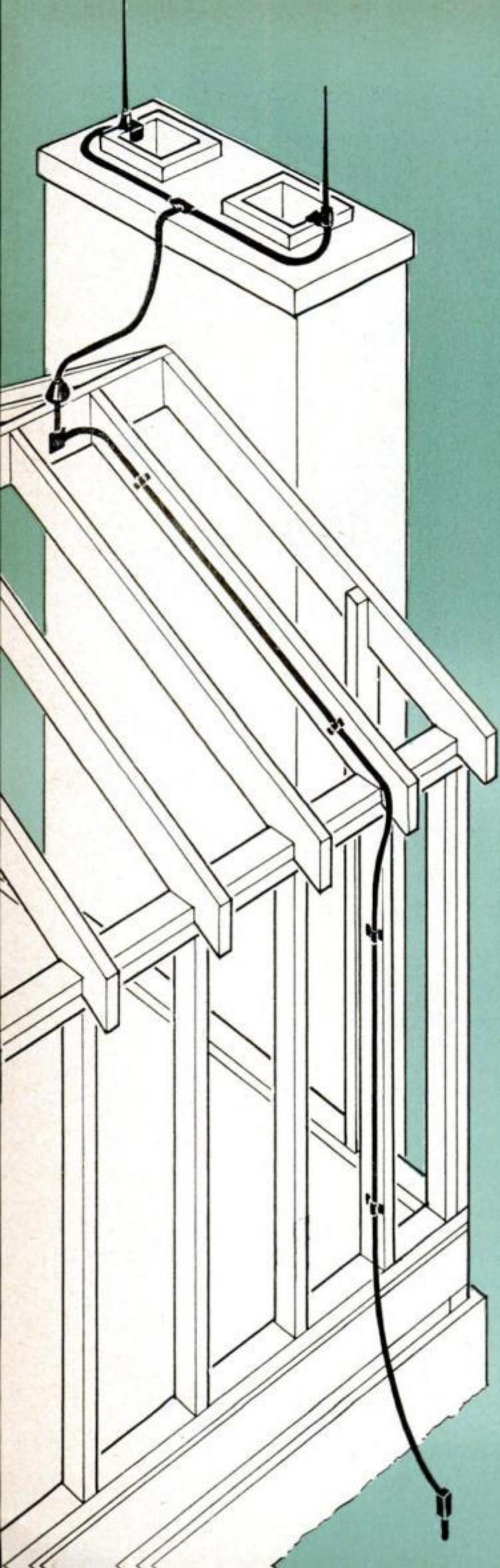
Do rods really work? The answer is a

flat Yes. A good installation is nearly 100 percent effective in preventing lightning damage.

Then why don't you see them on more modern houses, in areas where electrical storms are frequent? Mainly because they have been stripped of glass balls, ornate points, whirling vanes, and other unnecessary gimcrackery. Now a mere 10 inches high and pencil-thin, they're not easy to spot. Conductor cables, too, are usually either completely concealed or artfully camouflaged. And they're made of real metal these days.

Do you need them? The answer depends mostly on where you live. Consider these situations:

- Chances of your home being hit if it is in a heavily built-up town are very



## **Modern lightning rods are inconspicuous installations**

**THIN POINTS 10 INCHES HIGH** are usually the only visible indication. In new construction, the conductor cables are often completely concealed, as at left. If they run outside, the cables can often be camouflaged, or flat copper can be used and hidden under the shingles.

slim. There are too many other good targets—water towers, tall buildings, industrial smokestacks—on which lightning can spend itself.

- Chances of a strike in a suburban or rural area are much greater. A building that stands in the open is a prime target. The lone tree, the lone house on a grassy hilltop—these are sitting ducks. Because lightning strokes almost always knock out power supply and phone, the remote house is not likely to have any means of fighting a resulting fire, or calling for help. More than a third of all rural fire loss stems from lightning.

- If you live where storms are frequent, long lasting and severe, your danger is obviously increased. In the U. S., most storms occur from Pennsylvania west to Nevada, and south to Florida. Fewest develop in the far west. Locally, storms often follow river valleys, and at the intersection of two valleys they may hit hardest and linger longest.

High plateaus, too, are choice targets. If you sweat out every storm, rodding may be worth while just for the peace of mind it brings.

**Do rods attract lightning?** Not to the house. They don't "draw" it, or in any way change the probability that it will strike. Neither do they repel it, or drain off charges before they build up into a strike, as Ben Franklin, the rod's inventor, thought they did.

When lightning strikes in their immediate vicinity, rods do attract it to themselves and conduct it harmlessly to the neutralizing earth. Lightning is as tame as a baby when it can have its own way and nothing hinders its passage to the ground. It gets rough only when it has to slam a path through nonconductors such as roofing, lumber and masonry, on the way down.

Lightning is static electricity. How it's generated is not completely understood, but we do know that the turbulent air in a thundercloud separates electrical



**HIGH-RIDING TV ANTENNAS** are lightning rods in themselves and should be properly tied in with the protection system. Here a mast is being bonded to a rod's down conductor cable.

charges and makes those in the top of the cloud positive and those in its bottom negative. Lightning strikes when the negative cloud charges become powerful enough to jump the air gap to earth to join positive charges they have attracted to the surface there.

Before the stroke occurs, the positive earth charges follow the scudding thundercloud like a shadow, surging up into trees, houses and anything else in their path. Any structure high enough to shorten significantly the gap between earth and cloud is likely to encourage a stroke.

**How lightning rods work.** Special cameras show that as positive earth charges surge up into a house in the path of a thundercloud they tend to flow off the rod points as corona-like streamers, known as St. Elmo's fire. In the split second before a flash, the streamers may be 10 feet long or more.

Meanwhile, down from the thundercloud come the negative feelers, or flash leaders. The general direction these meandering leaders take is not influenced in any way by the rods, but any leaders threatening the house can't get by the powerful pull of the streamers.

The instant contact is made between leader and streamer, the main lightning stroke occurs. The entire elapsed time



**COMPLETE PROTECTIVE SYSTEM** must be able to handle sparks and sideflashes between metal parts of a house. Basement water and drain pipes are connected to ground and to each other.

from the sending out of the leader stroke to the main stroke may vary from 1/50 to 1/500 second, and the stroke may not consist of the single flash you see, but of as many as 42 strokes hammering in rapid succession.

When a rod is struck by lightning, you are likely to be unaware of it. It's even possible for an unrodded house to be struck without your knowing it. But even the single flicker, or "cold" stroke, which goes unnoticed when it hits an unprotected house may leave its mark.

In most cases you'll never find out. Leaks in gutters and downspouts that are caused by a flicker melting solder out of the joints, you'll blame on deterioration. Plaster cracks caused by a lightning charge surging through metal lath supporting the plaster, you'll ascribe to house settlement. These subliminal strokes can also produce foundation cracks, and these you'll probably blame on the man who sold you the house.

**Can a tree protect a house?** In city or country, any tall structure that is grounded, such as a water tower, metal stack, or steel-framed building, offers protection to the area around it. A metal tower 100 feet high will, with rare exceptions, intercept all strokes within a 100-foot radius and nearly all within a 200-foot radius. The protection diminishes to 25

## **How to behave during an electrical storm**

EVEN if your house has a good protective system, you should observe these precautions during a thunderstorm:

- Stay out of bathtubs and away from plumbing, radiators and the furnace. At the instant of a lightning stroke they may be charged with high voltage.
- Don't use a telephone or electrical equipment unnecessarily.
- Stay away from chimneys. Their lining of soot offers a good conductive path.
- Stay indoors. Next to the interior of your car, your home is about as safe a place as you can find.

percent of strokes within a 400-foot radius. For practical purposes, you can figure on complete protection for your house if it lies a distance from a tall structure no greater than twice the height of the structure.

A rod, being a well-grounded metal structure, offers a cone of protection equal to the height of the rod plus that of its corona streamers. With properly spaced rods, a house is thus completely shielded.

A tree, on the other hand, not only isn't grounded in an electrical sense, but is a poor conductor. If it's within 10 feet of a house, any stroke hitting it is likely to sideflash to the house where plumbing, BX cable and other metal equipment afford easier paths to the ground. Further, resistance of a tree to the passage of a stroke creates so much heat that the sap is often instantly converted into steam, exploding the wood into fragments. Because a tree showering a house with debris, or falling on it, could cause serious damage, those near or overhanging a rodded house are usually also protected with rodding.

A metal roof won't ward off lightning.

However, if it is electrically continuous and properly grounded, it can eliminate the need for rods on everything except chimneys and other objects projecting beyond it.

**What does rodding cost?** A typical installation made by a reputable contractor takes two men about three hours and costs \$300. Standard guarantee is for 50 years, with free replacement of parts that become defective. If you pro-rate \$300 over 50 years, and ignore the interest it might be earning for you in that time, it amounts to \$6 a year. In many areas, if your house is appropriately rodded, fire-insurance premiums are reduced 10 percent—usually a saving of \$4 to \$5 annually.

You can buy kits of all parts and materials required for a home installation by mail order from Sears, Roebuck. They will also furnish instructions for installing the system. However, though the kit parts are approved by the Underwriters Laboratories, you can't get UL approval for the installation if you make it yourself. Most insurance reductions are contingent upon the system having a UL Master Label, which can be issued only by a qualified installer.

Cost of a copper kit for a house with a roof ridge 60 to 80 feet long is about \$135. One in aluminum can be had for \$75. Aluminum is usually used only where the roof is made of that metal. It requires a larger cable, is more visible, and cannot be used where it will contact other metals, concrete or mortar, or the ground. Sears will provide UL-approved installation for about \$65 extra.

Is half a system better than none? Definitely not. An inferior or inadequate installation may be asking for trouble where none existed before. In an improperly rodded house, even without a direct lightning stroke, sparks and sideflashes may jump back and forth between plumbing, ductwork and other metal parts of the house, resulting in fire or personal injury. Even with a so-called complete installation, if you hear "clicks" during a storm it means that sparks are jumping and that important metal members of the house are not properly tied into the system and grounded. Under these

**Next Month: What makes hurricanes? Can we ever hope to stop them? September PS tells you what we're learning about these killer storms.**

conditions don't delay having a checkup made by an expert.

**What makes a system good?** Here's how to judge the quality and effectiveness of any installation:

- Look for plenty of points. On ridges, they should be no more than 20 feet apart. All projections above roof level, such as dormers, cupolas and chimneys, must have them. A chimney must have two points if its diagonal measures more than four feet.

- Look for at least two grounds, and these at diagonally opposite ends of the house. Lightning strikes "up" from the ground as much as it strikes down from a cloud. Earth currents rushing to a ground connection must have an unobstructed route. They won't take the long way around a house; they'll slam right through the foundation instead. If a house has over six points there must be three grounds. All grounds must be two feet from house foundations, 10 feet deep, and in permanently moist earth.

- Every rod point must have at least two separate cable routes to the ground. A single down route won't accommodate a heavy charge. No rod must be at a dead end over 16 feet from a cable with a double down route.

- Conductor cable must have no sharp bends. These encourage disastrous short cuts. Cable must lead horizontally or down.

- Every metal system in the house must be bonded together and grounded. This includes plumbing, heating, BX ca-

ble, TV masts, ventilating systems and guttering.

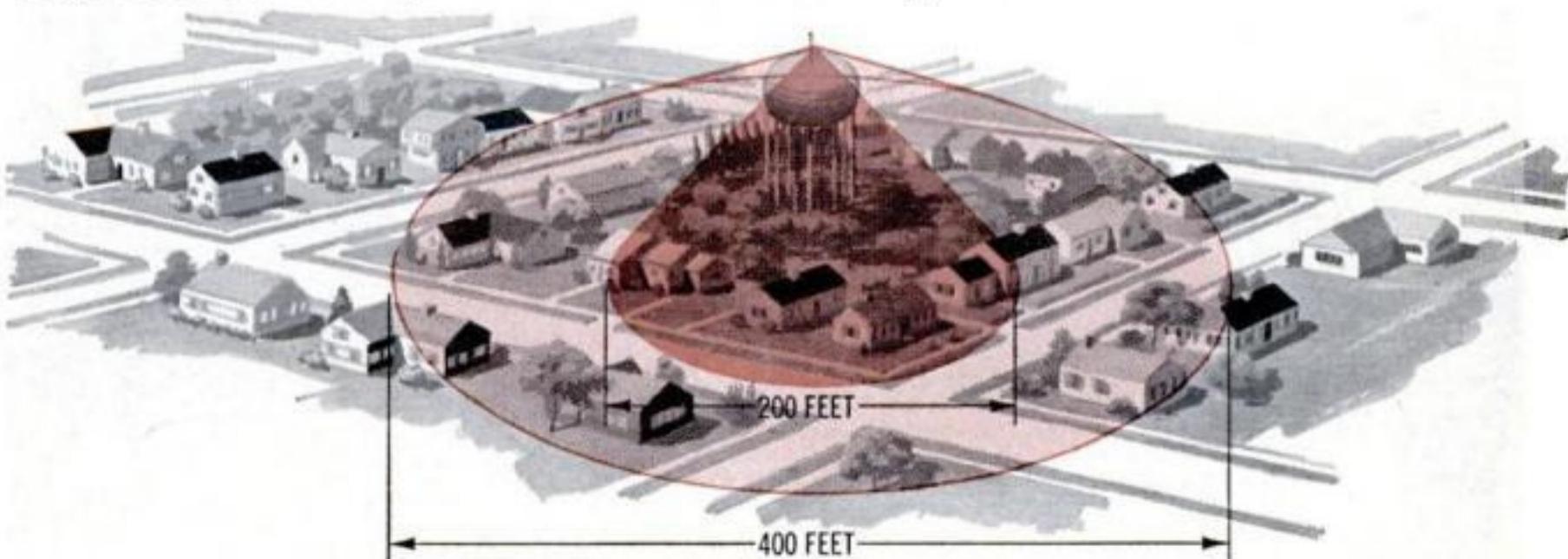
- All rods and cable must be securely fastened; they have to stay in place for the life of the house. To verify that a system remains complete and intact after installation, many contractors list it for periodic inspection. When repairs are made, it is important to check that workmen who may be unfamiliar with the system do not remove any of its connections.

- Rods won't protect your house wiring system against destructive surges of current caused by a strike. These surges can blow fuses, damage ranges, water heaters and appliance motors. A special service-entry protective device is needed to divert these overloads to the ground. It, as well as lightning arrestors for radio and television antennas, should always be included as part of the overall protective system.

Underwriters Laboratories spot-checks 25 percent of all installations made by its licensees. If yours is not one of these, and you suspect that your UL Master Labeled system is not all it should be, you can request an inspection. UL will make one if it feels there is justifiable cause. There is never any charge to the consumer for this Underwriters Laboratories inspection.

A final word. Lightning is famous for freakish and unpredictable behavior. On at least one occasion it set fire to a house, then jumped to a nearby pole and turned in a fire alarm. But don't rely on its always being so helpful.

### Tall structures spread an umbrella of protection



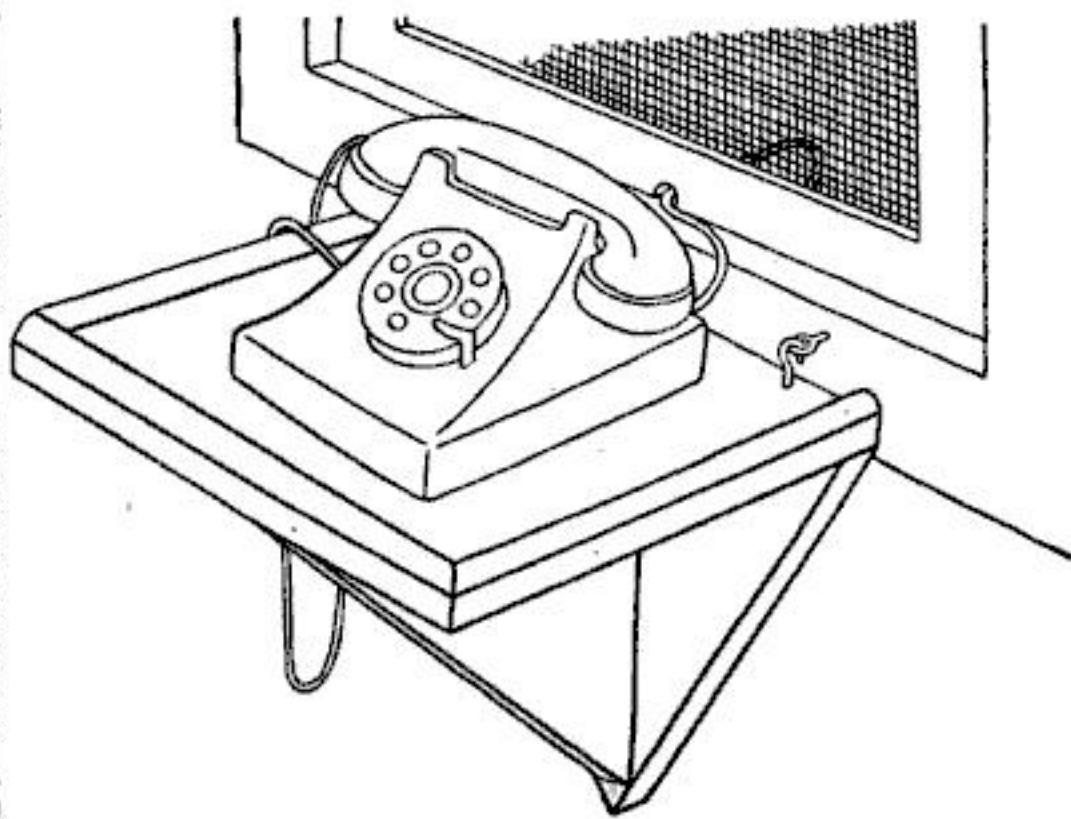
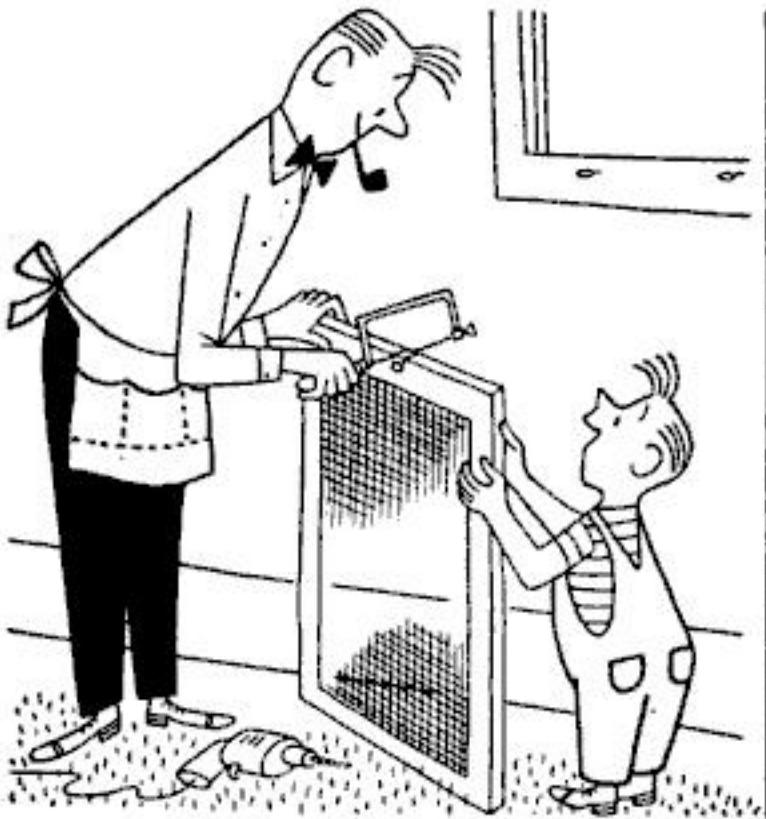
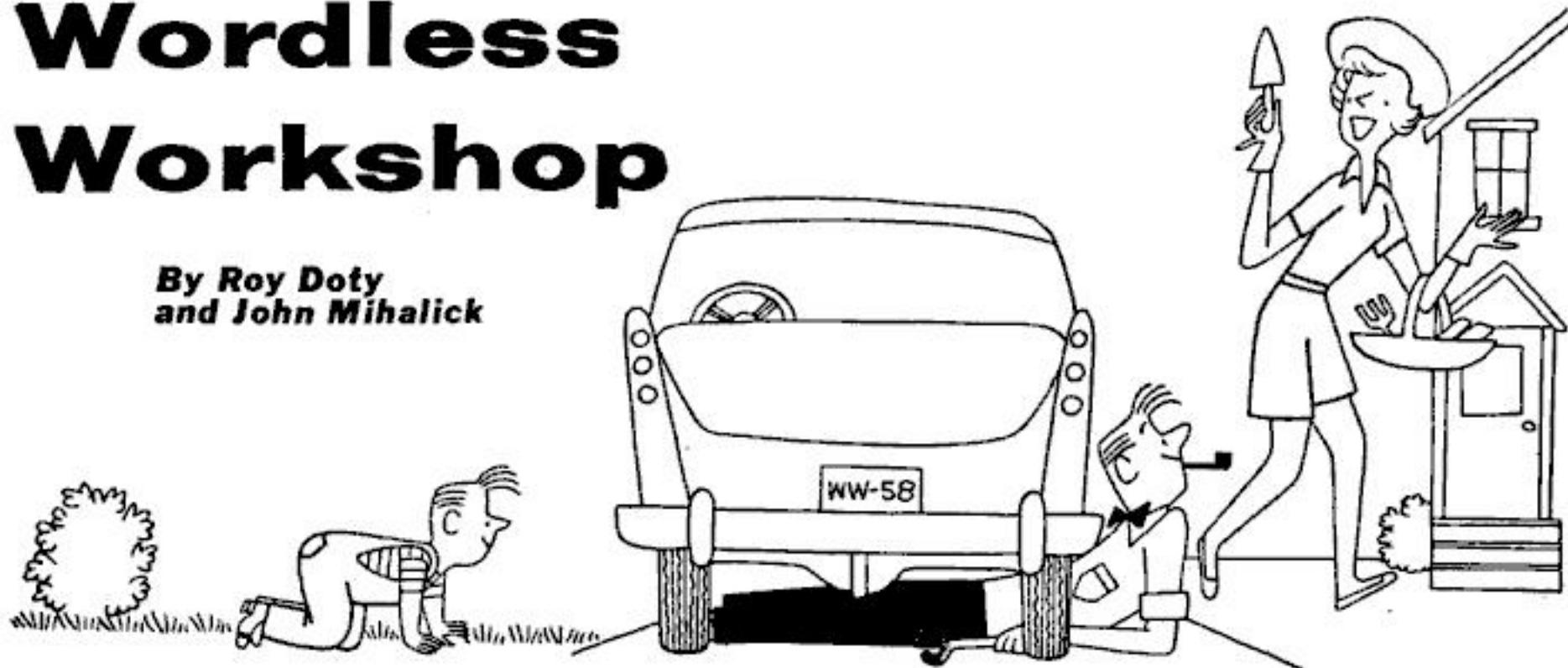
**ANY GROUNDED METAL STRUCTURE** 100 feet high will intercept virtually all lightning strokes within a 100-foot radius, most strokes within 200 feet—and give 25-percent coverage up to 400

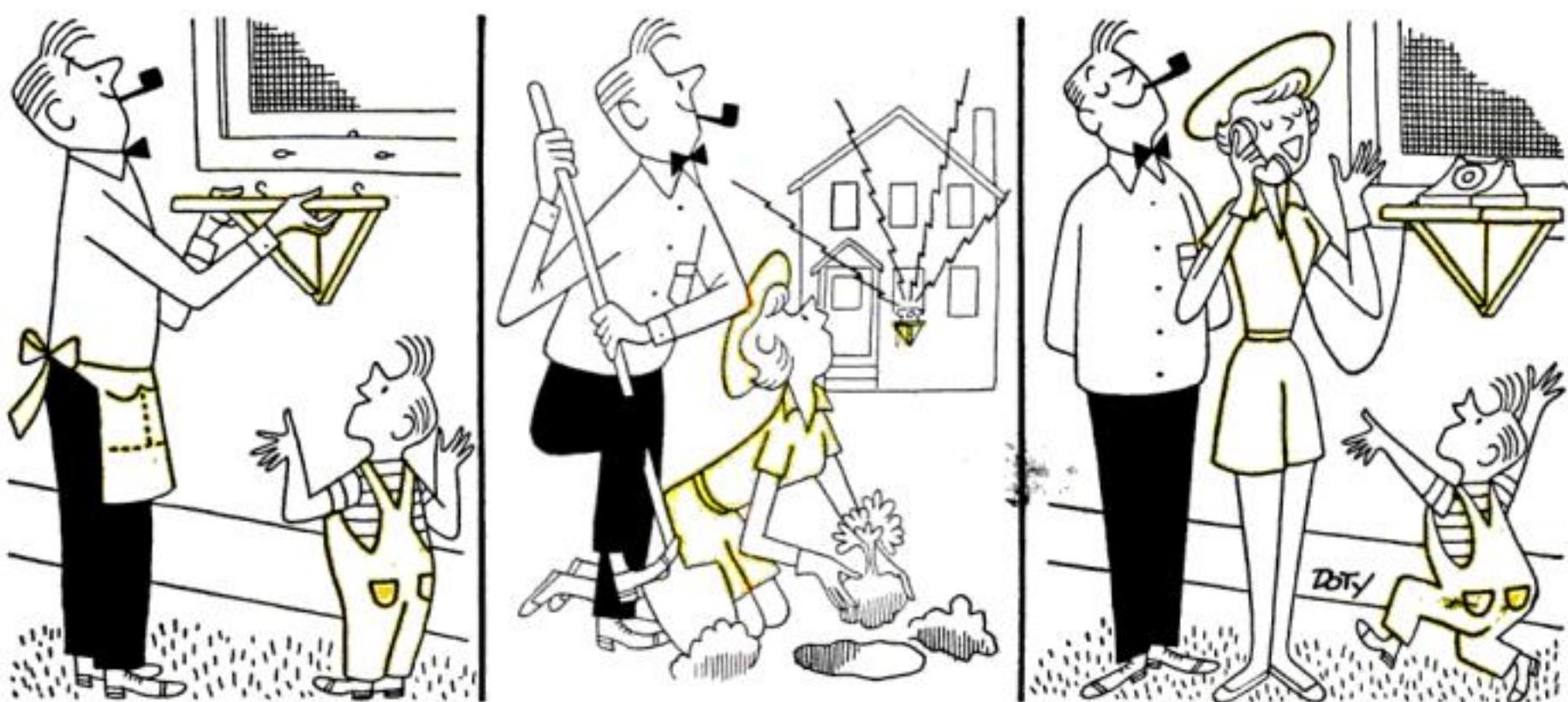
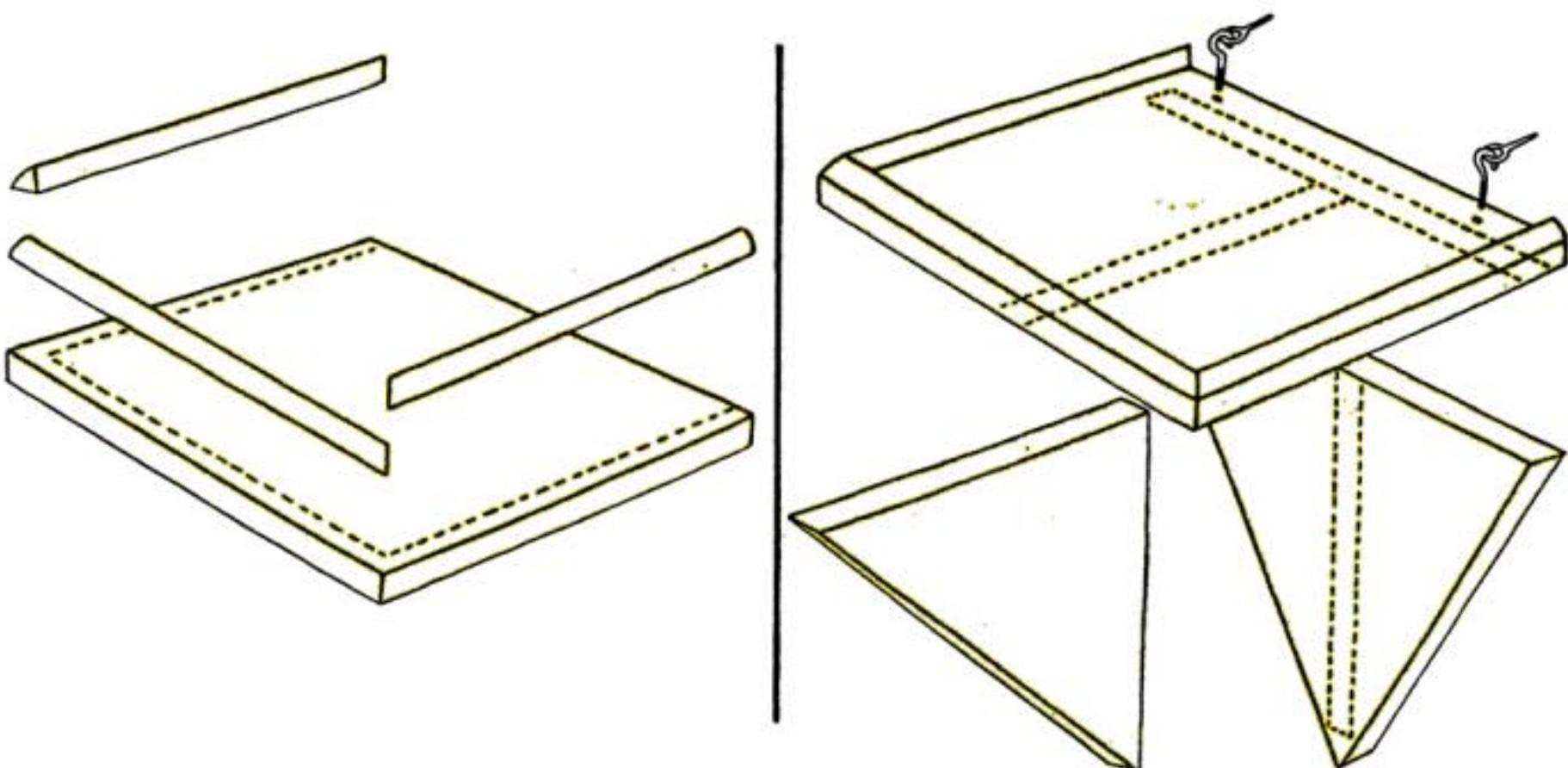
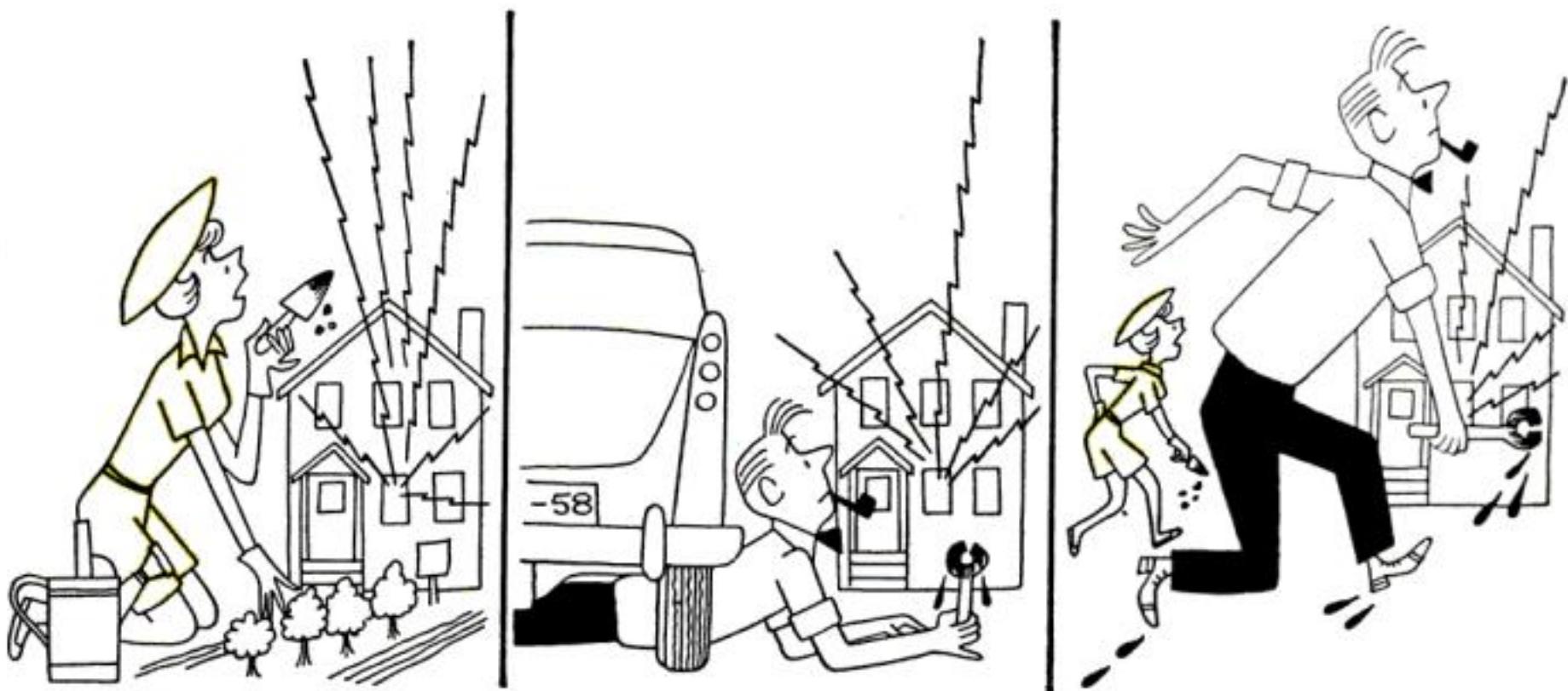
feet away. If your house is at a distance of not more than twice the height of such a structure, you have sufficient protection. Tall trees, on the other hand, offer no such safeguard.

END

# Wordless Workshop

By Roy Doty  
and John Mihalick





**Next Month: A trick doorbell you can hear through the whole house**

AUGUST 1958 119

# Look What You Can Do with New Plastic Foam

By Paul Corey

HERE'S a new plastic foam that cushions, grips and insulates like foam rubber. But it's much stronger, weighs half as much, usually costs less. Called polyurethane, or just urethane, it's made of petroleum, natural gas, and salt.

Urethane foam comes in sheets, slabs and adhesive-backed strips. Colored foam is promised in a big way soon; it's already here experimentally. The new plastic foam also boasts:

- Durability. No covering is needed. You can cut, nail, glue, cement or sew it. Decorative painting can be applied.
- Washability. Hose it down, run it through the washer and dryer, or have it dry-cleaned. Stubborn spots can safely be removed with cleaning fluid.
- Safety. Heat doesn't harm it; flame won't ignite it, but causes melting.

You can buy urethane in many department and variety stores. (A square foot of 1"-thick sheet costs from 60¢ to 75¢.)

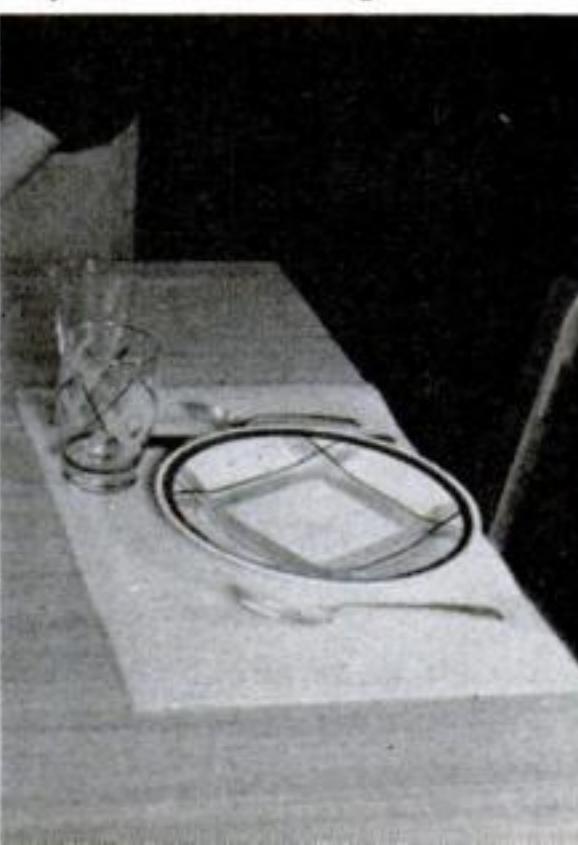
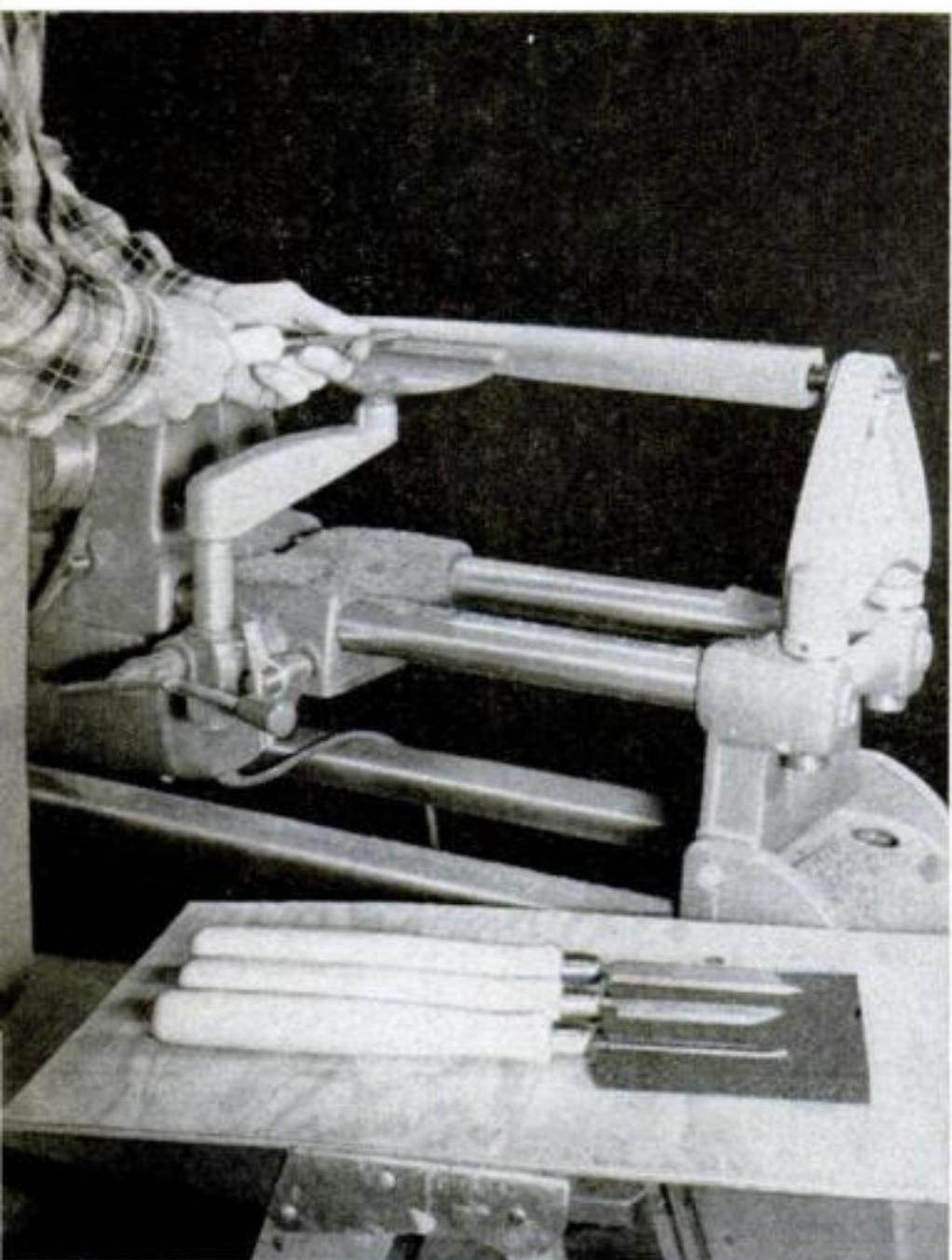
**Further information on urethane foam and where to buy it can be obtained from the following:** F. Burkhardt Mfg. Co., St. Louis 7; A. J. & J. R. Cook Co., S. Pasadena, Cal.; Dryden Rubber Div., Sheller Mfg. Corp., Portland, Ind.; Du Pont Co., Wilmington 98, Del.; Mobay Chemical Co., 405 Lexington Ave., NYC 17; NOPCO Chemical Co., Harrison, N. J.; Poly-Tac Creations, 2337 Washington Ave., Bronx 58, N. Y.; United Mineral & Chemical Corp., 16 Hudson St., NYC 13.

**IN THE WORKSHOP** a foam pad protects the sharp edges of tools—like these wood-turning chisels. A small sheet of foam on the workbench serves as a nonskid resting place for tools that tend to roll out of reach or off the bench.

**SNACK-COUNTER STOOL** has a soft cushion of 2"-thick foam that was cut to fit exactly. The foam needs no covering and can be cleaned with a damp rag.

**CUT TABLE PLACE MATS** from  $\frac{1}{8}$ "-thick foam. White or colored sheets can be used; you can even decorate them by the silk-screen process.

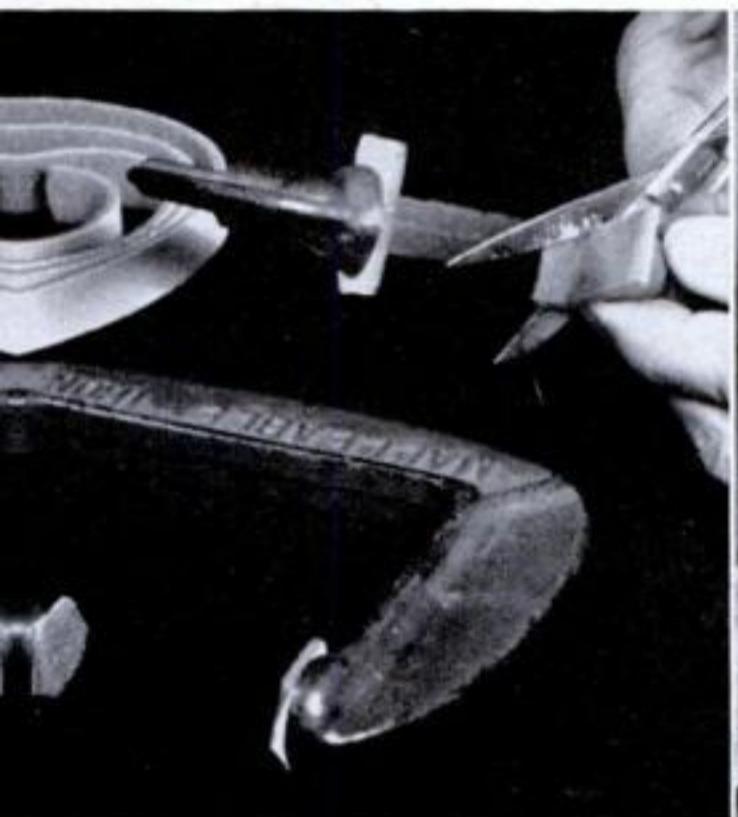
**UPHOLSTER UNPADDDED CHAIRS** by attaching foam with contact-bond cement. Use 1"-thick sheet on seats and  $\frac{1}{2}$ "-thick sheet on the backs of chairs and benches.



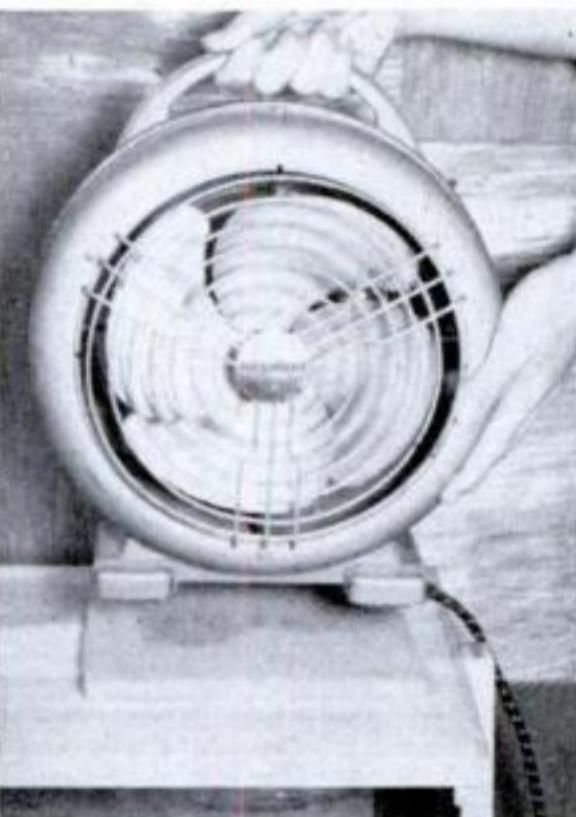


**SUN-BATHING MAT** is a sheet of foam only 1" thick; it replaces a cotton pad 4" thick. Lighter

and less expensive than cotton, the foam pad can be left outdoors without a cover.



**SOFTEN THE BITE** of a C clamp or small vise by padding the jaws with strips of adhesive-backed foam. Let the pads overlap the jaws slightly.



**REDUCE VIBRATION** from a fan or small shop tool by setting the object on a sheet of foam. Then the table won't act as a sounding board.



**GET A BETTER GRIP** on a worn hammer handle by winding an adhesive-backed foam strip around it. This also works on tennis rackets and golf clubs.



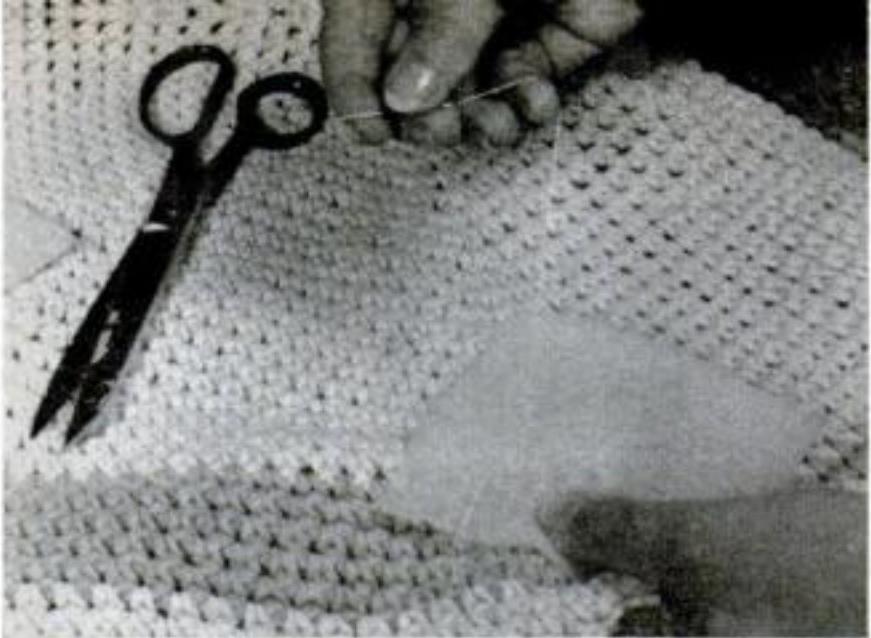
**BUMPERS** on a vacuum-cleaner wand prevent it from scratching and denting the legs of your good furniture. Stick on foam strips backed with an adhesive.



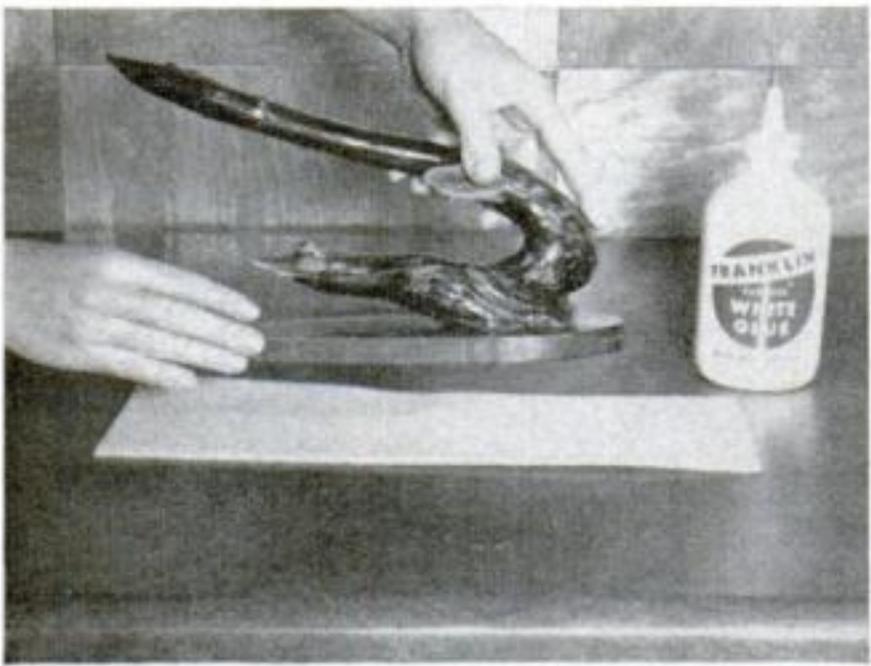
**PROTECTIVE STRIP** saves furniture from being marked by doors. Adhesive-backed foam is pressed on, can be safely and easily pulled off later.



**SLIPPERY CLOTHES** stay put on a hanger that has strips of adhesive-backed foam on the shoulder pieces. Foam clings to material. [Please turn the page.]



**MAKE RUGS NONSKID** by sewing patches of foam on the underside, as shown. Or lay the rug over a sheet of  $\frac{1}{8}$ " foam cut slightly smaller.



**BASE PADS** to protect table tops from lamps, clocks and art objects can be  $\frac{1}{8}$ "-thick foam glued on. Use the base outline as a pattern.

### Three ways to cut plastic foam



**BANDSAW, ELECTRIC HANDSAW, SCISSORS** cut foam neatly. The bandsaw is best for cutting out intricate shapes, such as a stool cushion, from thick foam slabs. Use a fine-toothed blade on

### Use plastic foam also for:

- Low seating. Make cushions of 5"-thick foam for sitting on the floor.
- Replacing a baby mattress. Cut out a new mattress from thick sheet foam.
- Shelf covering. Glass and chinaware won't slip or bang on a  $\frac{1}{8}$ " foam sheet.
- An auto crash pad. Contact-cement 1" sheet foam to your car's dash.
- Weatherstripping. Use adhesive-backed foam on door and window cracks.
- Protecting hi-fi records. Put a disk of  $\frac{1}{8}$ " foam on the phono turntable.
- A table pad. A thin foam sheet under the tablecloth keeps it from slipping.
- Quieting casters. Stick a strip of adhesive-backed foam around caster wheels.
- Gasket replacement. You can replace gaskets around a car hood or door with it.
- Insulating food containers. Wrap hot or cold food in a blanket of  $\frac{1}{2}$ " foam.

an electric handsaw and slide the saw on top of a thin board. Scissors will snip through thin foam sheet or strip. Scraps are good filler for such things as stuffed toys and pillows. END



**How to recognize and avoid—**

## **10 Built-In Flaws No House Should Have**

**By John L. Springer**

**Y**OUR house may be a thing of beauty from the outside, but it won't be a joy for long if it's poorly planned inside. Mistakes are easy enough to spot once you've moved in and done a bit of family living—and it's too late.

It's sounder and less expensive to know the mistakes to guard against before you buy or build. A number of architects who specialize in small houses were asked to list major planning mistakes. Out of their replies emerged 10 common errors.

**No room for expansion.** Failure to an-

ticipate the need for more space is the mistake most often made by young home buyers, says architect Herman H. York of Jamaica, N. Y.

"A young couple finds a cute cottage, signs the papers and moves in. The house seems big at first. Then children arrive. They need more bedrooms, but there aren't any—the house is little now. With perhaps thousands of dollars invested, .....

*Next Month: Should you plan a basement for your house? Yes, in most cases, says an article that presents the down-to-earth case for this valuable space.*

## **It takes a heap of planning to make a house a home**

Houses shrink as families grow. That's only one of the problems home owners face if they fail to plan ahead when buying or building. And afterthoughts cost money. Reconstructing or adding to a badly planned house can run through a bankbook fast. The tips here can put you dollars ahead of the game and save those future headaches.



Value of a basement goes down if it doesn't have a wide outdoor entrance.

plus strong roots in the neighborhood, they have to pull out and move elsewhere—probably taking a beating on the sale of their house."

Attractive two-bedroom houses without expansion attics went up by the thousands after the war. Now they are hard to sell. Buyers have wised up to the fact that adding an expansion attic while the house is under construction costs only a few hundred dollars extra—and makes room to grow in when children need more privacy or parents come to live.

**Poor traffic patterns.** Stef Gudmundson of Ridgefield, Conn., cites this as a common planning defect.

The layout is faulty if you must walk through the living room to get from one room to any other room except the dining room; if you can reach the kitchen only by going through another room; if you can't reach an attached garage without getting wet on rainy days; or if you can't go from any bedroom to a bathroom without being seen from the living room.

A "highway" living room, for one thing, is certainly no mother's helper. She's always cleaning up after the youngsters who track in mud and drop their toys and boots while passing through. And if the kitchen isn't in a logical location, you may have to carry garbage out through the living room.



When you expand by selling a small house, expect to lose money on the transaction.



A good night's sleep can go out the windows. Place them with the *bed* in mind.

**Too much hall space.** Many architects say that no more than 10 percent of floor space should be devoted to halls. In some layouts, bedrooms can be reached only by going through a corridor, or halls separate the kitchen from the eating area. Valuable space is being used just to get from one part of a house to another.

Architect Rudolph A. Matern of Jamaica, N. Y., comments: "During a recent study, we found that 10 to 15 percent of the square-foot area in a poorly designed house could have been saved by good room arrangement. Such a mistake could amount to as much as \$1,000 to \$1,500 spent unwisely."

**Inefficient kitchens.** Important as it is, the kitchen is often the most poorly planned area in the house, according to many architects. A pet gripe: insufficient storage space.

"As kitchen equipment gets larger and new equipment is introduced, it cuts down the actual square feet of practical storage space," says Jules Reither of Sacramento, Cal. Other architects report that builders tend to skimp on kitchen cabinets because they cost more per square foot than any other item in the house. Yet housewives—especially in the suburbs, away from stores—like to buy a week's supply of groceries at a time, and need space to keep them.



A "throughway" living room invites traffic that creates a mess for Mother.



A picture window is a sad and costly blunder if it puts you in a goldfish bowl.

**Result:** Most modern kitchens lack enough room to store dishes, pots and pans, a big stock of canned goods, plus paper napkins, soaps and other cleaning equipment. Solution? "Let's go back to the old-fashioned pantry," says Mr. Reither. "It provides the greatest amount of shelving in the smallest space, at low cost—and helps eliminate the clutter found in so many of today's kitchens."

Other common kitchen complaints are that appliances are not laid out for efficient work (you should be able to move in a line from refrigerator to sink to range); that there is not enough counter work space next to each appliance, and that eating space in the kitchen is cramped.

**Bathrooms badly placed.** A great many new homes are being built with two bathrooms—one off the master bedroom for the parents, and the other off a hall for the children and everybody else. The result, says John W. Reese of Portland, Ore., is that guests usually wind up seeing only the heavy-traffic bathroom.

A better plan is to place both bathrooms off a hall—one for the children, the other, perhaps more glamorous, for parents and guests, and off-limits for the kids except in emergencies.

A lot of mud-tracking into the house can be avoided by a clean-up area with



Skimping on pantry storage space is risky: Where will you keep appliances?



You could call lack of a roof projection a minor flaw. Would this visitor agree?

lavatory near the back entrance or in the basement. Youngsters home from school or play can wash up before going into other rooms, and the parents can use it after working outdoors.

**No outside basement entrance.** "In a typical one-story ranch house the basement has about as much floor space as the main floor," says Mr. York. "Here's all the storage room you need, and also plenty of space for a future recreation room, workshop, laundry room, or photo darkroom. It makes sense to have this valuable space fully accessible to the outdoors.

"If you provide a separate exit to the yard, the children can come into the playroom without bothering anybody upstairs, servicemen can get in to read your meters, and you can store lawn furniture and lug in big panels for your woodworking shop without dirtying or disturbing the rest of the house."

In some developments, where builders pinched pennies too tight, houses have full basements not only without outside entrances, but with inside stairs too narrow to take bikes, baby carriages and other bulky items that should come in out of the rain or be stored in winter.

**Bedroom windows badly located.** Several architects pointed out this planning bloopoer. Seven feet of unbroken wall

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**NEXT MONTH:**

## A Big Special Section on How You Can Use Built-Ins

IN THE September issue of POPULAR SCIENCE you'll find 30 or more pages devoted to various aspects of space-making built-ins for the home, a subject of primary interest these days to every man who owns or operates a home.

You'll learn where you can get ideas and plans especially tailored to your needs. You'll find tips on construction if you want to build them yourself. You'll find that built-ins can be bought ready-made, too. And that's just the beginning. For the complete story, see September POPULAR SCIENCE.

.....

space is needed for a double bed. If your bedroom has two outside walls and you place windows in the middle of each, there probably won't be enough room. Putting beds under windows is not wise; cold coming down the glass may give you a permanent pain in the neck.

Best bet for the windows is at the end of walls, with room on the side for drapes. They should be placed so that the head of your bed is not in a direct line between the windows, or you'll be in a draft and a candidate for colds.

**Outdoor living neglected.** More and more home owners would like to spend some leisure outdoors—if they could still be at home. "In a good plan," says Albert P. Wittman of Home Planners, Detroit, "all facilities for outdoor living blend in with the overall plan of the house."

You and your guests should be able to go to a rear terrace or porch from the living room without having to walk through the kitchen, which is likely to be dish-cluttered when you are entertaining. A well-thought-out plan also provides outdoor or other easily accessible storage space for garden equipment, lawn furniture, bicycles and all the other impedimenta of suburban and country life.

**Picture windows without views.** As an example, Mr. Reither offers the case of several \$45,000 houses that were put up within 25 feet of a busy Sacramento

street. They have picture windows through which a steady stream of passers-by can look into the living rooms. One new home owner, tired of family life in a fish bowl, paid \$250 to close off the peep show.

Almost all architects agree that picture windows are desirable only where there is privacy plus a pleasing view. Where there's not, you're better off with ordinary windows.

**Noisy sleeping areas.** Are the youngsters kept awake by everyday social activities in the living room? Odds are that the bedrooms are separated by only a partition. Lack of a buffer zone to block out noise from living areas is a serious planning error that can be avoided.

Closets, which trap air, are an excellent insulation. A bathroom or a hall also can be planned to separate junior sleeping quarters from rooms that are used evenings by adults. In two-story houses there is usually a natural sound barrier—the air space between the ceiling of the first story and the floor of the second.

The big 10 do not cover all the pet peeves of the architects. Some of them are not major planning defects but just inconveniences. A clothes closet near the front door is handy, and so is a good, roomy linen closet. Lack of a separation between the front door and the living room can be a discomfort as well as an inconvenience, when a blast of cold air comes in every time the door is opened in winter.

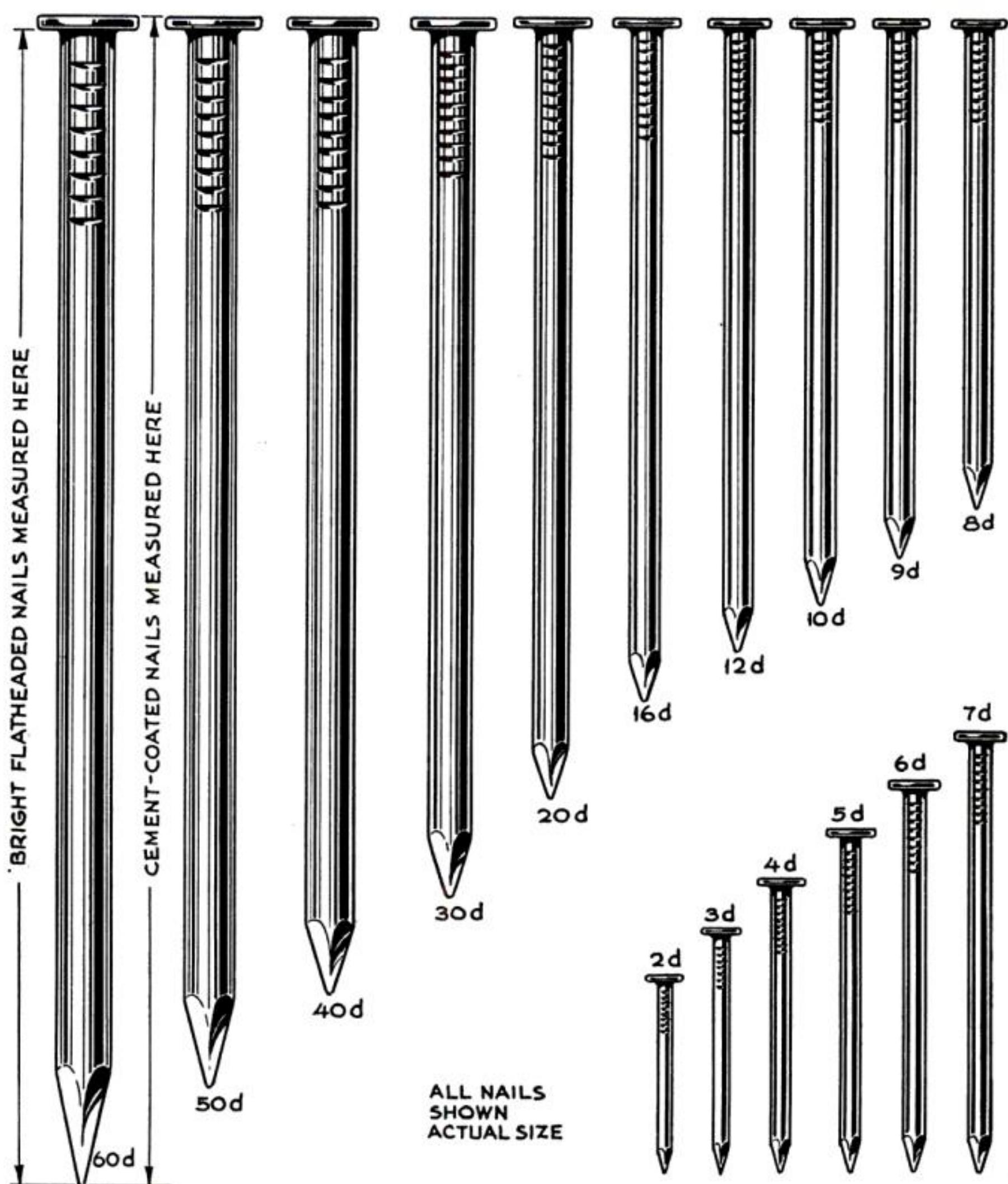
A roof projection over the entrance is, if nothing else, a courtesy for callers who ring your doorbell in a downpour. And better decide early if you're the fireplace type. That cheerful comfort for chilly nights can be an expensive afterthought.

There's an easy, inexpensive way to avoid these sins of commission and omission when you build. Make sure your house is designed by a competent architect—preferably one who spends most of his time drawing up houses rather than supermarkets or gas stations.

"Inexpensive?" you may well ask. Yes. Some of the most experienced architects sell blueprints for modest-sized houses by mail for as little as \$35. Hundreds of designs are available, so you're almost sure to find a plan that suits your needs, fits your budget, and will give you not only four walls and a roof but gracious living inside them.

END

# Common Nails



Size	2d	3d	4d	5d	6d	7d	8d	9d	10d	12d	16d	20d	30d	40d	50d	60d
Length	1"	1 1/4"	1 1/2"	1 3/4"	2"	2 1/4"	2 1/2"	2 3/4"	3"	3 1/4"	3 1/2"	4"	4 1/2"	5"	5 1/2"	6"
Gauge	15	14	12 1/2	12 1/2	11 1/2	11 1/2	10 1/4	10 1/4	9	9	8	6	5	4	3	2
Head dia.	11/64"	13/64"	1/4"	1/4"	17/64"	17/64"	9/32"	9/32"	5/16"	5/16"	11/32"	13/32"	7/16"	15/32"	1/2"	17/32"
Quantity per pound	845	540	290	250	165	150	100	90	65	60	45	30	20	17	13	10



## Filing the Facts

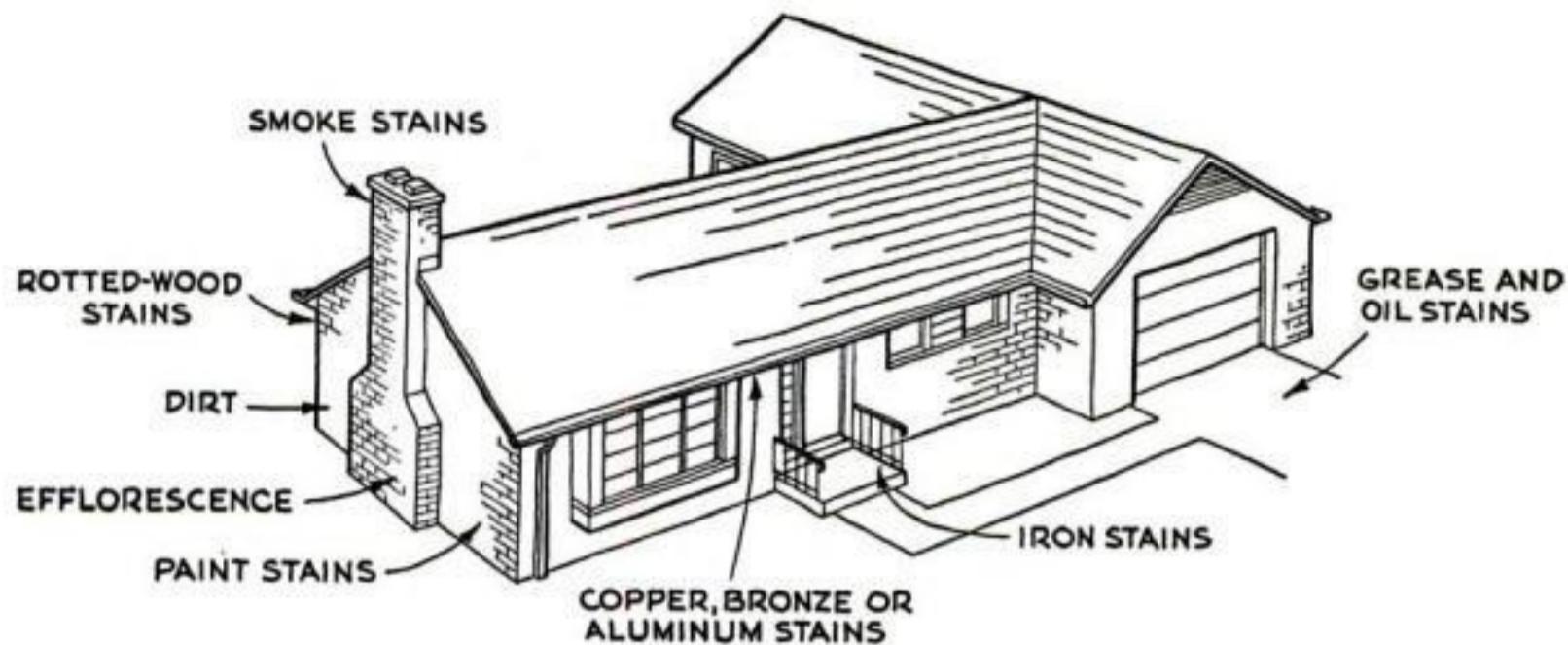
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# Masonry Stains

fix-it file



## Choosing the Right Chemicals, Bleaches and Solvents

TYPE OF STAIN	ACTIVE MATERIAL	SOLUTION	METHOD OF APPLICATION
Oil and grease	Fullers earth, hydrated lime, whiting, or Portland cement		Spread dry over stained area
	Gasoline or benzine		Scrub into stain with a stiff brush. Then wash with detergent and water
Rust	Oxalic acid	1 lb. acid to 1 gal. water*	Mop onto stain. After 2 hours, rinse with water. Repeat, if necessary
Copper, bronze	Sal ammoniac	1 part to 4 parts powdered talc	Stir in household ammonia solution to make a paste. Cover stain and let dry
Aluminum	Muriatic acid	1 part commercial muriatic acid to 2 parts water. Use 5 parts water for colored concrete*	Scrub into stain with a stiff brush. Flush off with clear water after 2 or 3 minutes. Then neutralize with ammonia solution (1 tablespoon per cup of water). Finally rinse with water
Efflorescence	Muriatic acid	Same as above	Same as above
Fire and smoke	Trisodium phosphate and chlorinated lime	Dissolve 2 lb. trisodium phosphate in 1 gal. hot water. Mix 12 oz. chlorinated lime to paste by adding water slowly. Pour paste and trisodium phosphate into 2-gal. stoneware jar and add water to fill. Stir, cover, and allow lime to settle	Saturate white flannel pad with liquid and place over stain. Cover with glass and let dry. Several applications may be needed
Rotted wood	Trisodium phosphate and chlorinated lime	Same as above	Same as above. Action may be speeded by first scrubbing the stain with glycerin diluted with four times its volume of water
Paint	Lacquer thinner or commercial paint remover		Scrub area. Then wash with detergent and water

\*Add acid to water slowly; never add water to acid

## Scrubbing and rubbing the stains away

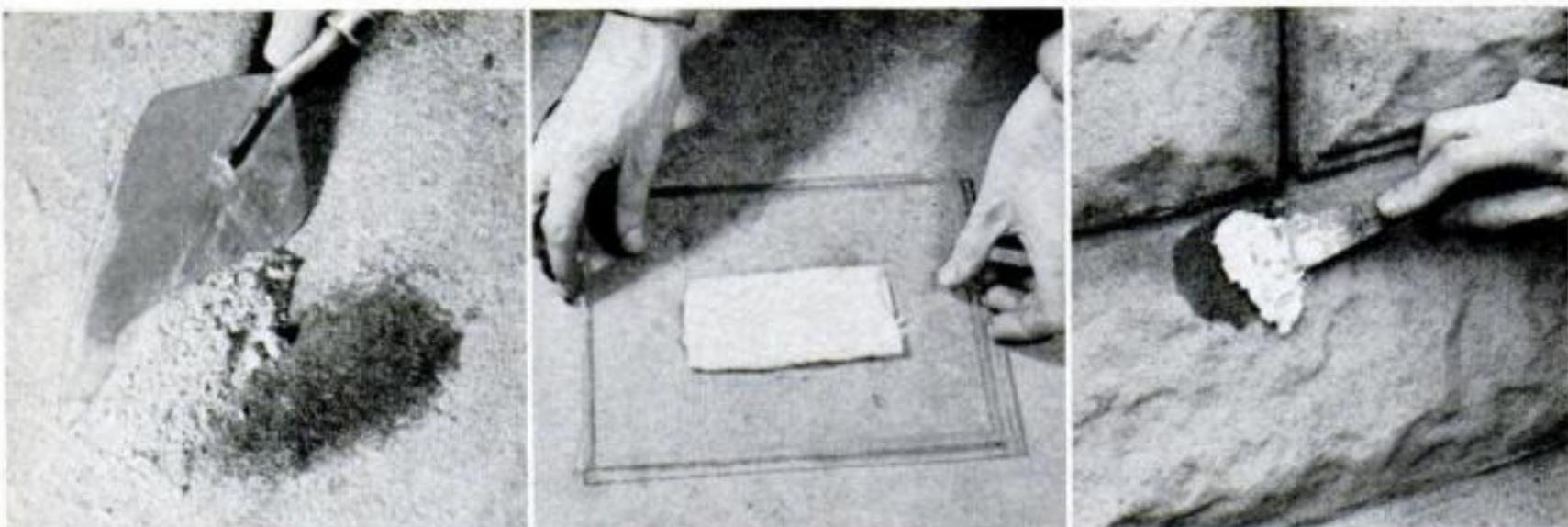
**DIRT AND GREASE STAINS** can often be removed by scrubbing. Use a detergent, cleaning powder, or soap—preferably one containing a sandlike abrasive. Apply with a scrub brush, then hose the surface with water.

**WIRE BRUSHING** may be all that's needed to improve the looks of a brick wall. Except in stubborn cases it will remove blooming (efflorescence), as well as mortar spatter and dirt. Wear a mask if dust is stirred up.

**RUBBING DOWN** stone and concrete surfaces with abrasive cloth or an old or broken grinding wheel is effective for discoloration that does not respond to scrubbing, solvents or chemicals. Use water as a lubricant.



## Treating the deep stains



**ABSORBENT POWDER.** Trowel dry fuller's earth, hydrated lime, whiting, or Portland cement over oil or grease stains and leave for several hours. Then remove, scrub with detergent and water.

**BANDAGES.** Saturate a pad made of four or more layers of white flannel or other absorbent cloth with a liquid bleach and apply it to the stained area. Cover with glass to retard evaporation.

**POULTICES.** Mix a liquid bleach with talc or whiting to form a paste (about mortar consistency). Spread it over the stained area. This is particularly effective for spots on vertical walls.

## Applying and neutralizing acids



**USE ACIDS SPARINGLY**—they can darken and roughen masonry surfaces and weaken mortar joints if the solution is too strong, or the exposure time is too long. Protect yourself from spatter with rubber gloves and an eye

shield. At left, above, commercial muriatic acid, diluted with two parts water, is scrubbed onto brickwork to remove stubborn efflorescence. After two minutes neutralize acid with ammonia rinse (see chart).



**RUST-STAIN REMOVING BLEACH**, made by dissolving two tablespoons of oxalic acid crystals in a pint of water, is mopped onto concrete with a rag (left). After two hours,



rub down area with clear water. Always mix and store acid solutions in glass, earthenware or acid-resistant plastic containers. Caution: Oxalic acid is poisonous.

# Trouble-Shooting an Automatic Washer

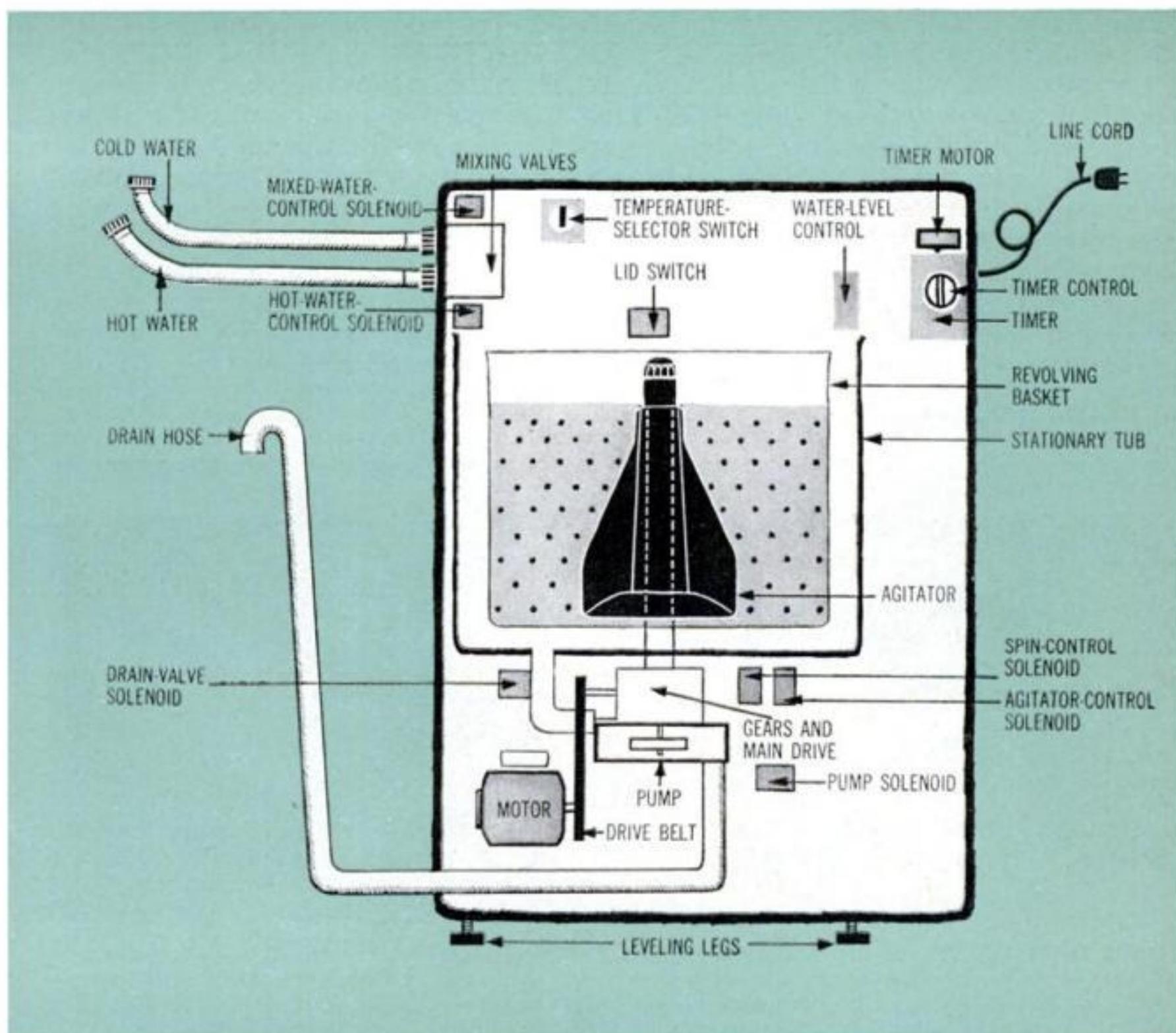
NINE breakdowns out of 10, you can coax an automatic washer back into operation with less bother than it takes to get on a serviceman's waiting list.

These machines all operate on the same principle. Basic trouble-shooting procedures apply to all types, whether front- or top-loading, agitator or rotating-drum. The cycle of washing operations—fill, wash, rinse and dry—is simply a series of individual functions of separate components, each with its own electric circuit that is energized at the proper time by a

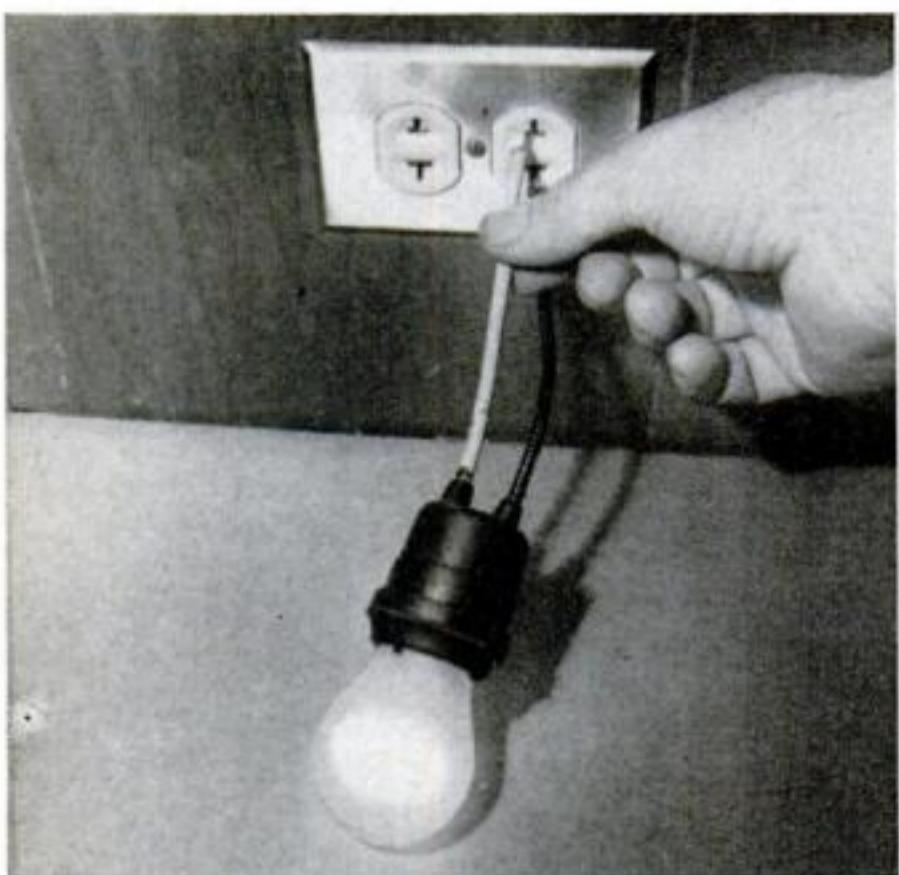
clock motor. It's like having a half-dozen clocks, each set to ring at a different time. If one failed to ring, you would check it and ignore the ones that did ring.

With only a homemade test lamp to tell you when a wire is live, and a continuity tester made from a fuse block to detect breaks in a circuit or loose connections, you can trouble-shoot each simple operation in the seemingly complex washing cycle. But first you should know what goes on inside the cabinet.

**How a washer works.** The machine



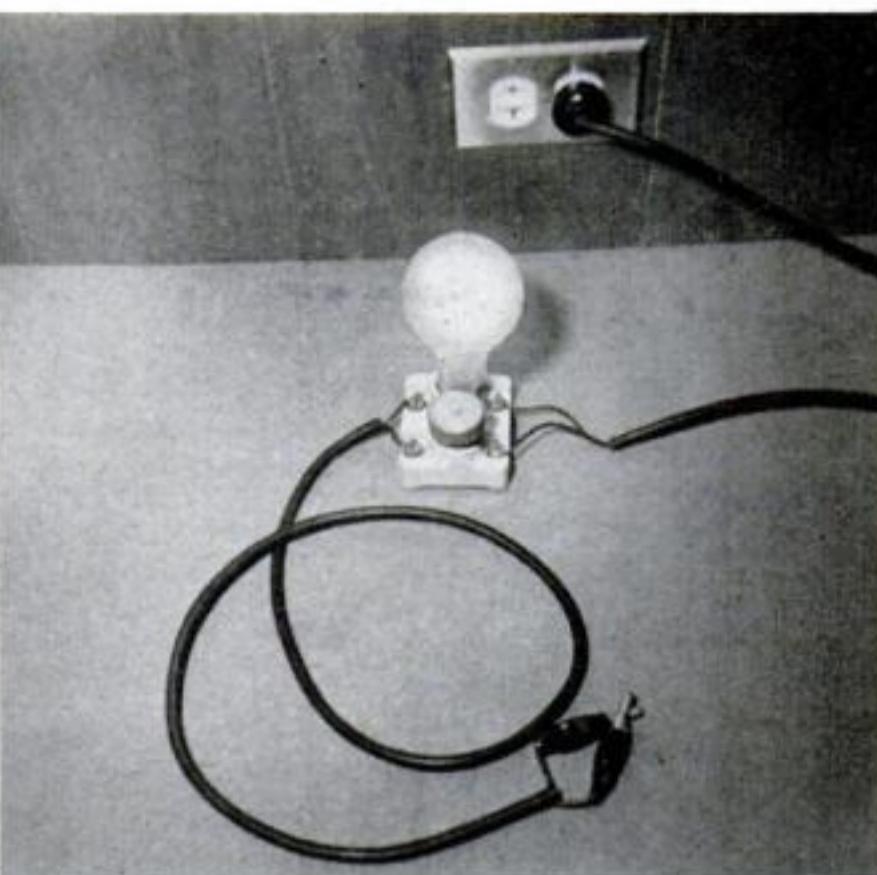
## Test equipment that you can make



**HOMEMADE TEST LAMP** tells you when a circuit is live. Make it from a bulb and a rubber socket that has two pigtail leads for use as probes. The light bulb should be of low wattage.

pummels the clothes in sudsy water for a while, rinses them a few times, then squeezes them dry. This is the same way clothes have been laundered since washboard days. The difference now is that a mechanical brain has been added, plus robot slaves to obey its signals.

The brain is a timer with several sets of contact points similar to those in your car's distributor. The robots are electromagnets called solenoids. As the timer is rotated by a clock motor, irregularly

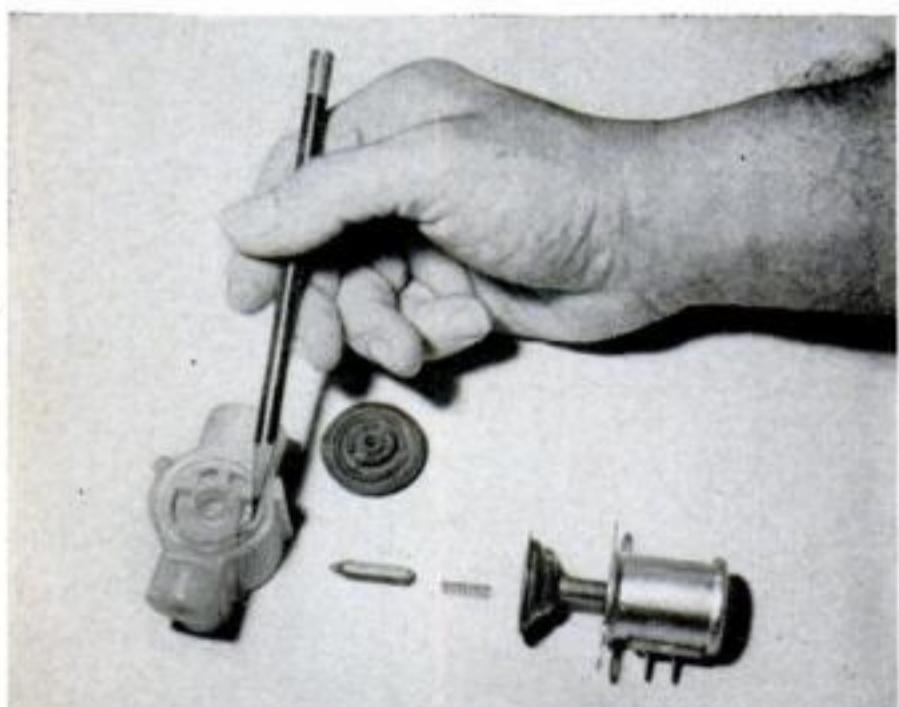


**CONTINUITY CHECKER** detects broken circuits. Cord passes current through fuse and bulb in two-socket fuse block. When probes are touched to parts of closed circuit, the bulb lights.

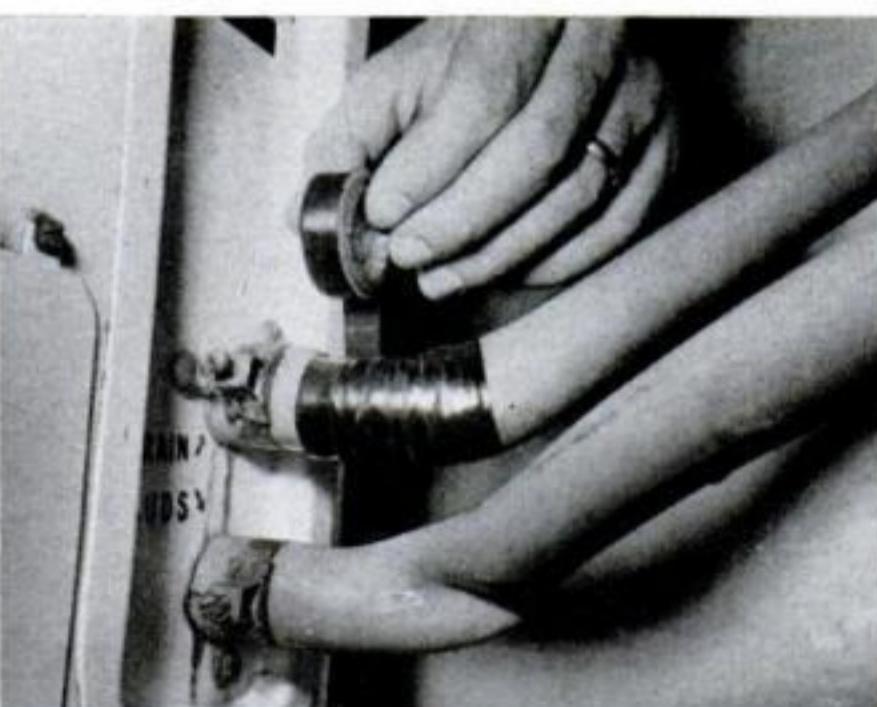
shaped wheels called cams open and close the contact points to actuate solenoids in the various parts. They do such jobs as opening and closing the water-inlet valves to fill the tub, pulling the drain plug when washing is done, and engaging a clutch to start the basket spinning and whirling the clothes dry.

Usually, only one device operates independently of the timer. This is the water-shutoff switch, which bosses the job of filling the washtub.

## Mechanical testing

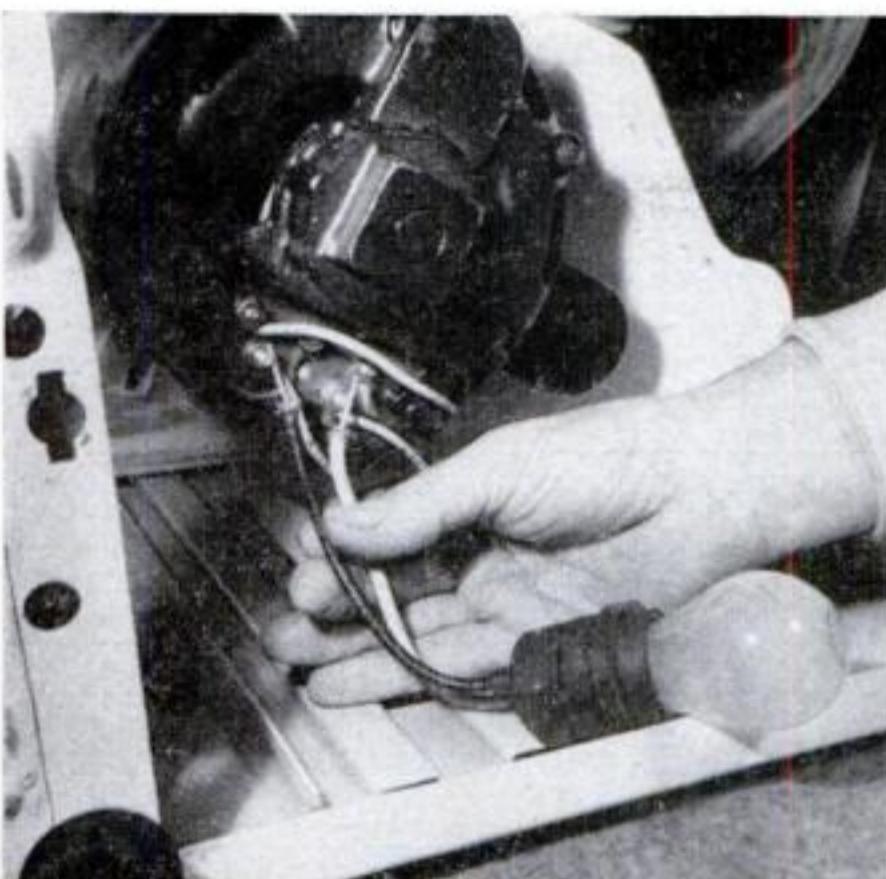


**DEFECTIVE INLET VALVE** (shown by pencil) is often restored to service simply by cleaning its inner parts. Bullet-like plunger is moved by solenoid to open valve and admit water.



**KINKED HOSES** can impair the washer's operation. If they've softened or taken on a permanent kink, use plastic electrical tape to stiffen the rubber and force it back into shape.

## Electrical testing



**TO SEE IF MOTOR IS GETTING VOLTAGE**, touch its terminals with the test-lamp leads. Here, lamp doesn't light, indicating that the trouble lies elsewhere and is not in the motor.

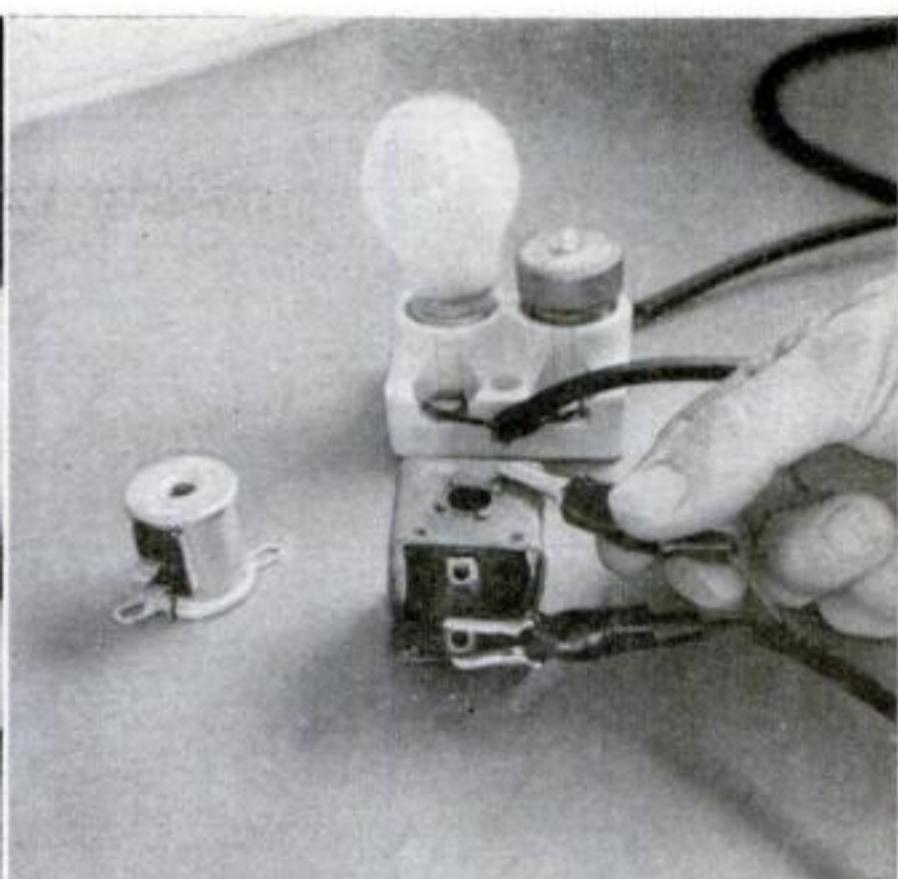
At any setting of the control knob, one or more parts may be working. When the knob is on DRY, for example, the circuits leading to the drain pump and the high-speed clutch are energized. So, when checking a specific trouble, such as an inoperative drain pump, be sure the control is set for that phase of the washing cycle. Otherwise you might find yourself checking a part when it's not supposed to be operating. The control knob overrides the timer for setting any operation by hand.

**Electric trouble-shooting.** Before you remove any parts that seem to be the cause of trouble in the machine, use your test equipment to be sure the part is getting the current it needs to function. If the motor doesn't run, for example, be sure the line cord is plugged in and the control is turned on. Then touch the leads of the test lamp to the motor's terminals.

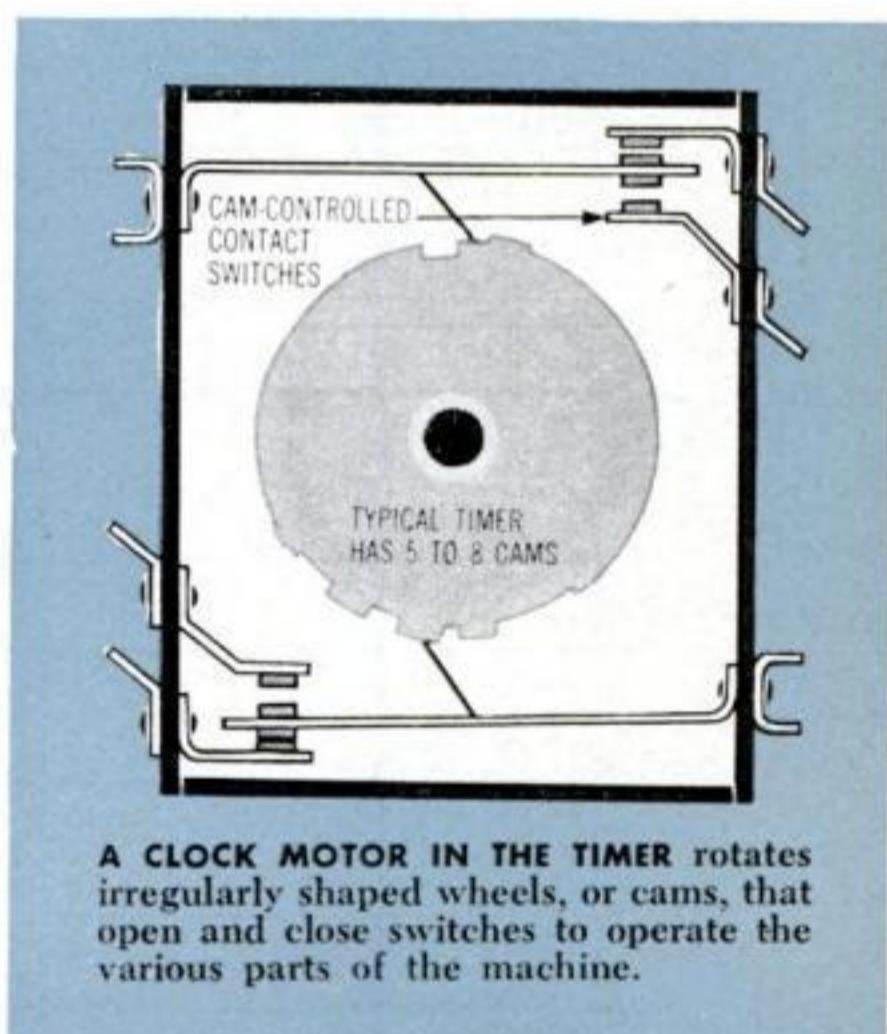
- If the lamp lights, the motor is getting voltage. So the trouble must be within the motor, or its overload switch is open.

- If the test lamp doesn't light, current isn't reaching the motor. Check the circuit back to the timer.

- If the lamp shows that the timer is getting voltage but doesn't pass it through to the motor, the trouble lies inside the timer.



**TO RULE OUT A SHORT CIRCUIT** inside a solenoid, one leg of the continuity checker is touched to a terminal, the other to the outer cover. The bulb would light if there was a short.



A CLOCK MOTOR IN THE TIMER rotates irregularly shaped wheels, or cams, that open and close switches to operate the various parts of the machine.

Trace other electrical troubles in the same way:

- If no water enters the tub, see that current is reaching the solenoids that open the inlet valve.

- If water won't drain out, check the pump solenoid.

- If the tub won't spin, see if the spin solenoid is energized.

- Wherever you find that current isn't

## Your Quick Guide to

TROUBLE	POSSIBLE CAUSE	WHAT TO DO
No water enters tub	Supply valves shut off	Turn valves fully open
	Kinked or clogged hoses	Clean or replace hose. Realign kinked hoses
	Clogged strainers	Clean or replace
	Defective water-inlet valve or solenoids	Check with test lamp and continuity checker
	Washer frozen	Freezing may be in water lines or in inlet valve. Allow to thaw, then check for possible leaks in valve assembly
	Water-level control faulty	On float type, check if float operates freely, or is stuck in up position. Check switch operation
Water won't shut off	Water-level control faulty	Check for float stuck in down position. Check switch
	Excessive water pressure	If water pressure of over 100 pounds is problem in your area (check with water department) have pressure regulator installed
	Water-inlet valve stuck open	Flush it clear by switching machine on and off several times with cycle at "wash" and temperature-control switch at both hot and warm. If this fails, disassemble to clean
Water temperature wrong	Hoses reversed	Whenever hoses are disconnected, be careful to reconnect them to proper ports
	Temperature-selector switch or inlet-valve thermostat defective	Check operation. Replace if necessary
	Water-inlet valve or its solenoids faulty	Check solenoids for defects. Disassemble and clean out valve, replacing worn or damaged parts
	No hot water	Wait till heating tank recovers temperature. If necessary, correct heating-system defect
Motor hums, but doesn't run	Overload of clothes	Remove part of load
	Suds lock	Too many suds create serious drag on motor. Use less soap or detergent. Flush out excess suds with cold water
	Jamming	Check agitator and basket for article stopping their movement. If they are clear, test motor for jamming by disconnecting it. If motor now runs freely, jamming is in transmission—a job for serviceman
	Low voltage	Eliminate long extension wires. Restrict use of other equipment on same circuit
Motor dead	No current supply	Check if outlet is live and line cord making good contact with it. Replace fuse, if required. If replacement blows, check for short in machine
	Overload switch open	Disconnect line cord from outlet and allow motor to cool for at least 5 minutes. It should then start. Some types have manual reset button on motor
	Faulty timer	If timer has voltage, but relays none to motor, timer is defective
	Motor defective	If test light shows motor is getting voltage, motor needs repair or replacement. Job for serviceman

getting through, check the timer's input and output terminals.

Frequently, your test lamp will show that electricity is reaching a part, yet it won't function, possibly because of a broken or shorted wire inside. Use your continuity checker to pinpoint the trouble within the part.

The **continuity checker** shown on the preceding pages is simply an electric bulb wired so that current has to travel through the suspected part to light it. Caution: Unplug the washer from its power source before making continuity tests, as the checker supplies its own current. Also, when checking a part or a wire

# Automatic Washer Troubles

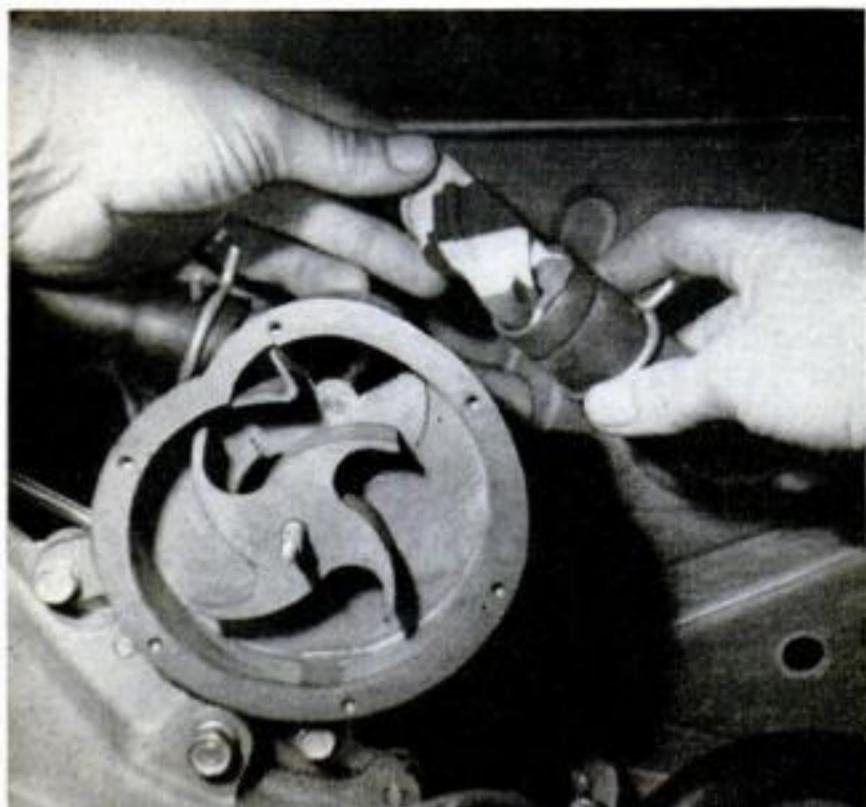
TROUBLE	POSSIBLE CAUSE	WHAT TO DO
Water doesn't drain properly	Drain hose kinked or clogged	Clean or realign, as required
	Water pump clogged or defective	If tub is full, try to free clogging by hand, turning pump pulley back and forth. Then disassemble pump and clean. If impeller is damaged, replace it
	Pump belt or pulleys loose	Tighten pulleys, increase belt tension
	Timer or pump solenoid defective	Use test lamp to check operation and replace if necessary
	Obstruction in tub outlet	If possible, reach between basket and tub to remove clogging article
Abnormal noises	Loose transmission	Tighten transmission on its mounting. If transmission noise is internal, call serviceman
	Defective belt	Replace frayed, worn or stretched belt
	Loose basket	Tighten nut holding basket
	Nails, bolts or other items caught between basket and tub	Remove basket, if necessary, to get at them
	Loose parts lying on bottom pan of machine	Remove parts from pan and replace them where they belong
	Unbalanced load	Redistribute load. In washing a blanket, rug or other single heavy item that makes it difficult to distribute load, balance with small items
	Improper lubrication	Follow manufacturer's lubrication instructions exactly
	Deteriorated solenoid	Check for poor connection, or dirty or corroded plunger
Excessive vibration, or machine walks	Machine off-level	Adjust leveling feet so machine is both level and resting squarely on all four legs
	Unbalanced load	Follow manufacturer's directions on loading. (See above)
	Loose tub-suspension rods, mounting bolts, springs, shock absorbers, cabinet, pulleys	Tighten all loose parts
	Packing blocks or rods still in place	Blocks are meant only for use when machine is shipped. Remove
Washer leaks water	Leaky hoses	Tighten connections. If there is leakage around coupling joint, replace washer
	Defective pump, door, cylinder, lid gaskets	Tighten or replace
	Tub overflowing	Use less soap or detergent. Overflowing can damage solenoids, wiring, motor
Machine won't spin	Loose nut holding basket	Tighten
	Off-balance load	Redistribute load. If off-balance (vibration) switch kicks out too soon, change adjustment
	Spin solenoid defective	Use test lights to check solenoid. If solenoid good, but its adjustment is off, call a serviceman
	Timer or water-level control defective	Water-level controls can often be adjusted or repaired. Defective timer should be traded in
	Drag of water that hasn't drained out	Check drains, drain hoses, pump, controlling solenoids, and timer
	Defective drive	Job for serviceman

for continuity, you must isolate it by disconnecting its terminals. Otherwise it may show false continuity through adjacent circuits that bypass it. A solenoid may give a positive continuity check at its terminals, but still be shorted.

Check for a short by touching one test lead to a terminal and the other to the so-

lenoid's outer housing. If the lamp lights on this test, a short is definitely indicated. Because this type of testing will occasionally blow a fuse, it's a step-saver to include a fuse—preferably the resettable circuit-breaker type—as part of the checker.

By using the test lamp and continuity



**A REAL SOCKEROO!** A child's sock lodged in the drain hose put this machine out of action. Clog-ups occur at the pump, too. Remove the housing and inspect impeller and pump chamber.

checker with the wiring diagram (on the back of your machine) and the troubleshooting chart, you can trace the flow of current through the timer to all the machine's parts. If the wiring diagram is missing, write to the manufacturer for one, giving him the model and serial number of the machine. With it, you can trace wires by their code colors or numbers, or sometimes both.

It's a good idea—even though you have a diagram—to stick numbered tabs of masking tape on any wires you disconnect. Then, by scratching matching numbers beside the terminals, or sketching the terminal arrangement, you'll avoid a mix-up when hooking up again.

One final caution in the electrical department: If you feel a tingling sensation when you touch the machine, it indicates defective insulation or a partial ground somewhere inside. As a safeguard, permanently ground the washer's frame to a cold-water pipe with a clamp-on ground connector.

**Mechanical trouble-shooting.** Washers often develop troubles that are not electrical. So after testing to be sure an inoperative part is getting the current it needs, remove it for a physical check.

To gain access to the mechanism on some washers, it is necessary to remove the control knobs. But before you do this, look for removable panels at the side or rear of the machine, or in front beneath a swing-out loading door. If the trouble is

in the water system—overfilling, no water entering tub, water not draining—check for such obvious causes as clogged or kinked hoses, clogged strainers in the hose fittings or a stuck float in the water-shutoff control. Also make sure the machine is standing level.

An easy check of the washer's level can be made simply by looking at the water line in a partially filled tub. The water should be parallel with one row of perforations all around the tub. All machines have adjustable legs that screw in or out to eliminate tilt.

If you've traced trouble to the water-inlet valve, disconnect hoses and wire leads and loosen the screws that hold it in place on the cabinet. Many washer terminal connections are pressure fitted; simply pull hard to unplug them. Inside the valve you'll find spring-loaded plungers activated by the solenoids. See that they move freely. The most common cause of a leaky valve is a disintegrated bit of wire strainer screen that keeps the rubber closure from seating properly.

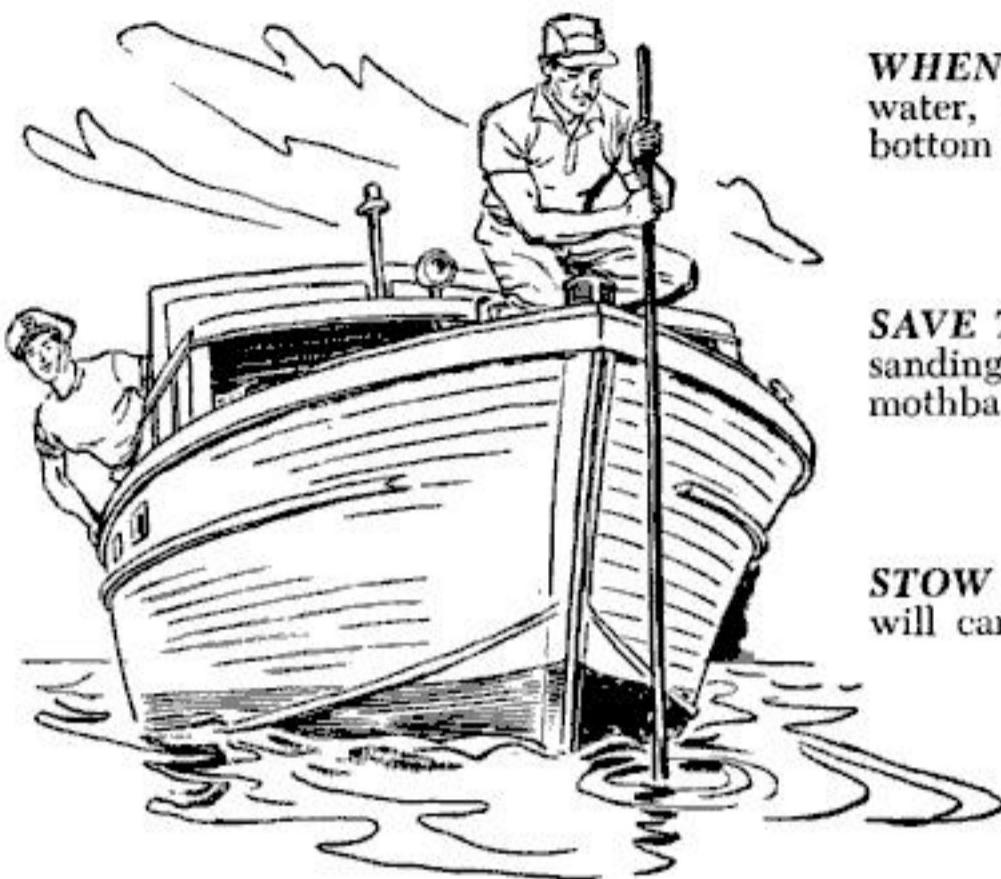
If water doesn't enter the tub or shut off when it should, check the float and the linkage to the shutoff switch. If the float doesn't move freely in its cup, remove it and clean the entire unit. Cotter pins usually connect the linkage.

When water won't drain out, look for small articles of wash, such as baby socks and ladies' handkerchiefs that sometimes get through and cause clog-ups in the hose or at the pump. Remove the pump housing and inspect the impeller. It may be jammed by a bobby pin, button or other small object sometimes overlooked in pockets, or it may be encrusted with scale. Clean it out with a scouring pad or a wire brush.

The timer motor comes out easily without disturbing the cam or contact points. Operate the motor on the bench by hooking up a line cord to its terminals. Now you can check the rotation of its shaft visually. Check the condition of the contact points and clean them with a carbide file or fine sandpaper.

If you spot a defective part and find you can't repair it, try trading in the part for a new one at your washing-machine-supply dealer. In small communities, out-of-town firms will often advertise new washer parts with the offer, "mail us your old parts."

# 10 Boating Tips



**LOOK AT THE TIDE BEFORE YOU BEACH** your boat. An incoming tide might cast it adrift.

**FOR A FACTORY FINISH**, wet-sand the final or midseason coat of varnish with fine wet-or-dry paper and water until it's glass-smooth.

**CUT A GROOVE** in the boat-hook handle so you can tell which way the hook points under water.



**WHEN IN DOUBT ABOUT THE DEPTH** of the water, station someone at the bow to probe the bottom with a boat hook, and proceed slowly.

**SAVE TIME NEXT SPRING** by filling hull dents, sanding, and applying prime coats before you mothball your boat for the winter.

**STOW A POWER HORN ON BOARD.** Its blast will carry farther in a fog than a whistle or bell.



**SEA SPRAY SOAK YOUR IGNITION?** To get under way fast, squirt plugs, wires, distributor and coil with a carbon-tet fire extinguisher.

**REMOVE PAPER LABELS** from canned goods and write their contents on the tin with a grease pencil to avoid a mixup if the cans should get wet.

**GOT A TIGHT BERTH AT THE DOCK?** Practice maneuvering and using the reverse gear in open water near a mooring or a buoy.

**SPINNING PINWHEELS** will scare off seagulls to keep your boat clean while it's moored.



## You need special spark plugs, too

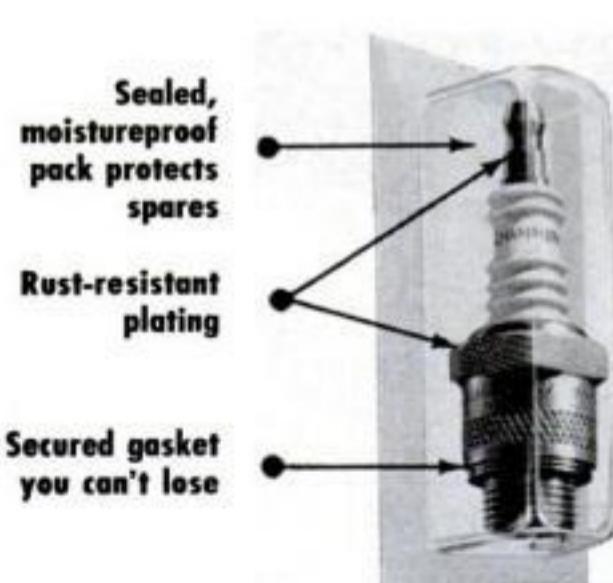
*Always use the spark plugs specially designed for outboards—***CHAMPIONS!**

The right life preserver is important for water safety. (For example, small children should always use jackets . . . not cushion or ring preservers.) The right spark plugs are important, too.

All Champion Spark Plugs for outboard use have a special electrode-gap design that fights fouling . . . helps keep your engine running with dependable smoothness. It's a good idea to have a set

of marine Champions in your engine—and a spare set in your tool box. The moistureproof pack keeps plated marine Champions clean and dry—always ready for use. Plated to prevent rust, these new Champions have the gasket secured to prevent loss.

Always use Champion marine spark plugs. They deliver the dependable power that wins almost every major outboard race.



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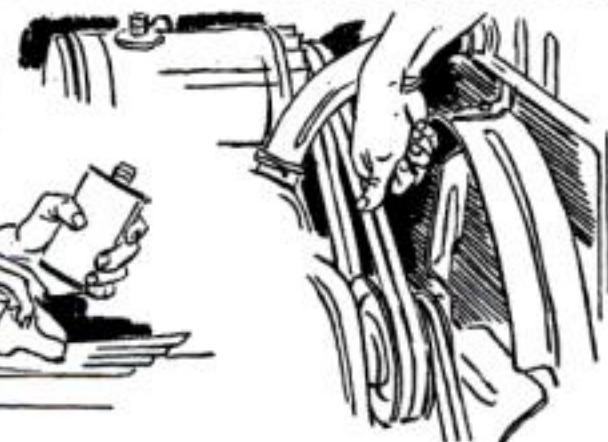
**EVERY MAJOR OUTBOARD MANUFACTURER APPROVES—AND USES**

**CHAMPION**

**SPARK PLUGS**

# 10 Tips for Summer Driving

**CHECK FAN-BELT TENSION** if your engine tends to run hot. A slipping belt reduces efficiency of the fan and water pump.



**STOP GLARING REFLECTIONS** on hood trim by coating the chrome with metal polish. It dries to a white powder that kills glare.



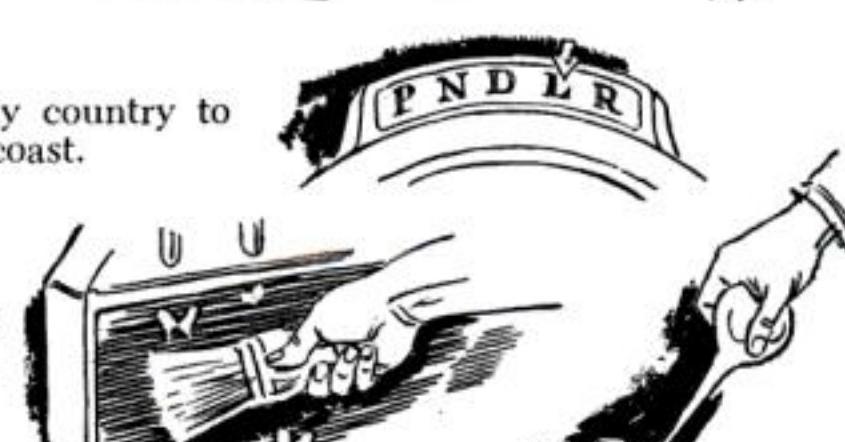
**WHEN ADDING WATER** to an overheated cooling system, use warm water or pour in cold water *very* slowly to avoid damaging engine parts.



**OVERHEATING IN TRAFFIC ON A HOT DAY?** Lift the hood slightly and prop it open with a rolled-up newspaper to vent off engine heat. Be sure the safety latch engages.



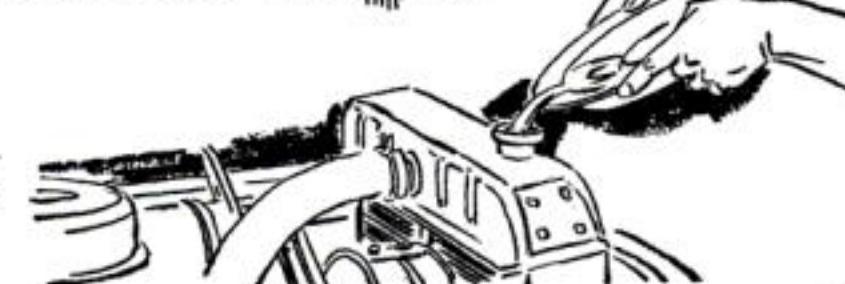
**CARRY A PLASTIC SQUEEZE BOTTLE** full of water and squirt it on the windshield occasionally while you operate the wipers to remove bugs, road dust, or mud spatters thrown up by other cars.



**USE LOW RANGE** when going downhill in hilly country to keep brakes from overheating and fading. Never coast.



**LOOK AT THE FRONT OF THE RADIATOR** occasionally when checking the water. Bugs accumulate quickly and restrict the flow of air.



**CHECK THE BATTERY** once a week in hot weather. Engine heat causes the electrolyte to evaporate more quickly in summer.

**USE HUBCAPS AS BUCKETS**, during emergencies, to carry water to a cooling system that's running hot. Or try the windshield-washer bag.



*"Maybe that mower could beat mine," said the fat man smugly.  
"But the way things look, you won't even get it rolling."*

## Gus Takes a Stitch in Time

By Martin Bunn

**D**ON'T mess around with that mower!" growled the beefy, red-faced man to a group of small boys gathered around the rear of his truck. "Look, but don't touch—or I'll tan your hides!"

Stan Hicks came out of the Model Garage. "Can I help you, sir?"

"Gas up the truck and give me five gallons in that can back by the mower."

"Hot day for mowing," Stan said.

"Might be for some mowers, but this here's a Trail Blazer. Me and it is gonna win the competition at the County Fair this afternoon."

Stan inserted the hose in the gas tank

and said, "Oh, you mean that Park Commission contest?"

"Yep. Winner gets a contract for nine mowers. That's me. Hop to it, son. Time's a-wastin'."

"All set," said Stan, handing up change for an extended \$10 bill.

"Then away I go," roared the man, settling his belly behind the wheel. "I'm a-headin' for the Fair Grounds! Yahoo!"

**S**OME hours later Gus came out of the Model Garage office in his good suit, holding a needle and a spool of thread.

"Pulled a button off my coat," he said to Stan Hicks. "I wouldn't go at all if it weren't that Hank Sawyer wants all us Park Commission members to be at the



grounds for the power-mower judging."

"Yeah," said Stan. "I talked to one of the contestants this morning."

"Nice commission for the winner," said Gus. Standing in the light by the open shop door, he poked the thread at the eye. It bent, the needle fell to the ground, and Gus, muttering, "Dagnab it!" stooped to pick it up.

A shabby station wagon pulled up and a young woman stepped out. "May I use your phone?" she asked.

"Yes, ma'am," Stan said, beaming. "Right here on the desk."

"Oh, thank you. I want to let my mother know that Bill—that's my husband—and I won't be home for dinner. We're giving a demonstration at the Fair Grounds, and it looks like we'll be late."

Stan grinned. "My boss, Gus Wilson," he nodded toward the figure bent over a needle and thread, "was just on his way



to the fair when he lost a button. Been trying to sew it on for five minutes."

The girl walked over to Gus. "Let me do it." She threaded the needle deftly, and had the button in place in a jiffy.

"Thanks," said Gus. "Guess I'm handier with a wrench. Well, I'm off, Stan. Probably see you at the fair, Miss."

"STEP right up, Gus," Ted Miller barked, "and get some real old-fashioned cotton candy."

Gus ambled up and plunked a quarter down on the counter.

"Things sure have changed since we were kids," he mused. "Used to buy this stuff for a nickel."

"I know," Ted agreed as he spun off a generous ball onto a paper cone. "Here, wrap your tonsils around this."

Gus had barely swallowed a mouthful when he began to cough and choke. Ted thumped him on the back.

"I'm too old for this stuff," Gus said, grinning. "Clogged my windpipe." He moved along toward the power mowers.

The display was housed in a large tent at the far end of the midway. Gus sauntered inside, nodded to some friends, and stopped in front of the Trail Blazer.

"If you'll give me just one minute of your time," spied the fat-faced, paunchy salesman, "I'll show you the best rotary mower you ever saw."

"It's a fine-looking mower, all right," Gus agreed.

"Best buy the county can get. Here, I'll give you a little demonstration—on the house." He chortled, poking Gus in the ribs. "I tell you, mister, you better get your order in right now because after I win I'll be short of stock. A small down payment'll hold it for you."

"Well," Gus said, "I'm not exactly in the market for one. You see . . ."

"In that case, Jack, keep moving. Make way for the paying customers."

Two stalls away a young couple bent over a mower that was coughing asthmatically. Gus moseyed over.

"You seem to be having some trouble," he said. They both looked up, and Gus recognized the young lady who had sewed on his button.

"Hello, Mr. Wilson," she said. "I'm Ann Hawkins and this is my husband, Bill." She pointed to the stalled mower. "We just can't get the thing to go." She

explained to her husband, "Mr. Wilson is a mechanic. Maybe he can help us."

"I can fix it myself," said Bill.

"But, Bill, you've been working on it for over an hour." Ann turned to Gus. "Mr. Wilson, Bill just has to win."

"Couldn't you get another demonstrator?" Gus suggested.

"Not in time," Bill said. "All the others are in my shop at Vernon."

"You see," Ann explained, "Bill just bought this franchise for the Perfection Mower. We put all our money in it. Honestly, Mr. Wilson, it's the greatest."

"According to that supersalesman of the Trail Blazer, he's got things all sewed up," Gus said.

"That guy!" snorted Bill. "His mouth is too big. Why, this morning he was over, poking around, telling me how much better his mower is. Practically took mine apart finding fault with it."

"What have you looked for?" Gus asked.

"Well, I checked the condenser and there's plenty of spark. I replaced it, just in case. Still no luck."

"These little one-cylinder jobs can be pretty tricky," Gus said. "How about a high-resistance connection? Did you try that?"

"Yes, I did. There's nothing wrong with the coil." Bill checked his watch. "Confound it, we're running out of time!"

"Why not let me give it another check," Gus said. "That is, if you'll let me return your wife's good deed."

"Please, Bill, he might just find something you missed," she pleaded.

"What have I got to lose?" Bill said.

"You guys might as well save yourselves a lot of trouble." It was the fat Trail Blazer man, a smug grin on his face.

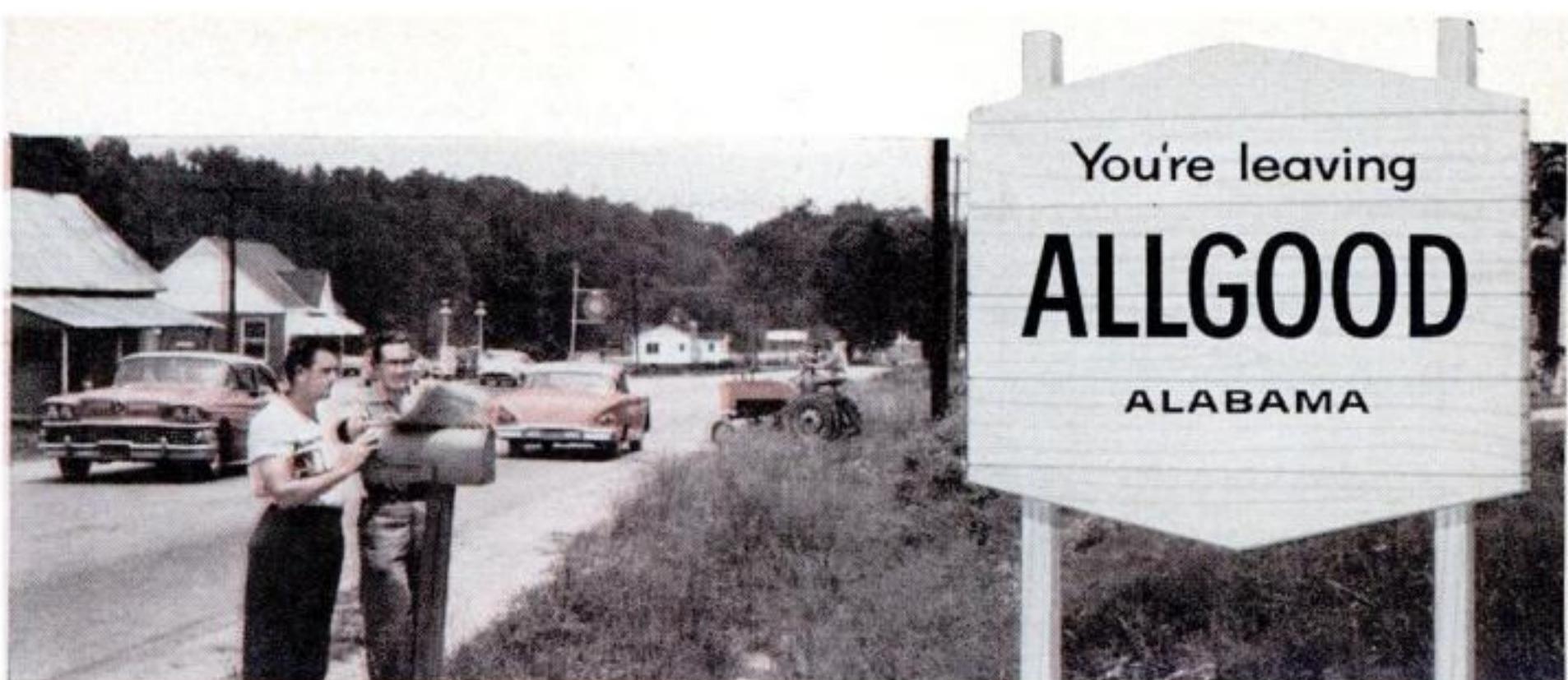
"You seem pretty sure of yourself," Gus said. "The battle isn't won before it's started, you know."

"Don't you be too sure," he sneered. "Maybe that mower could beat mine, but the way things look you won't even get it rolling."

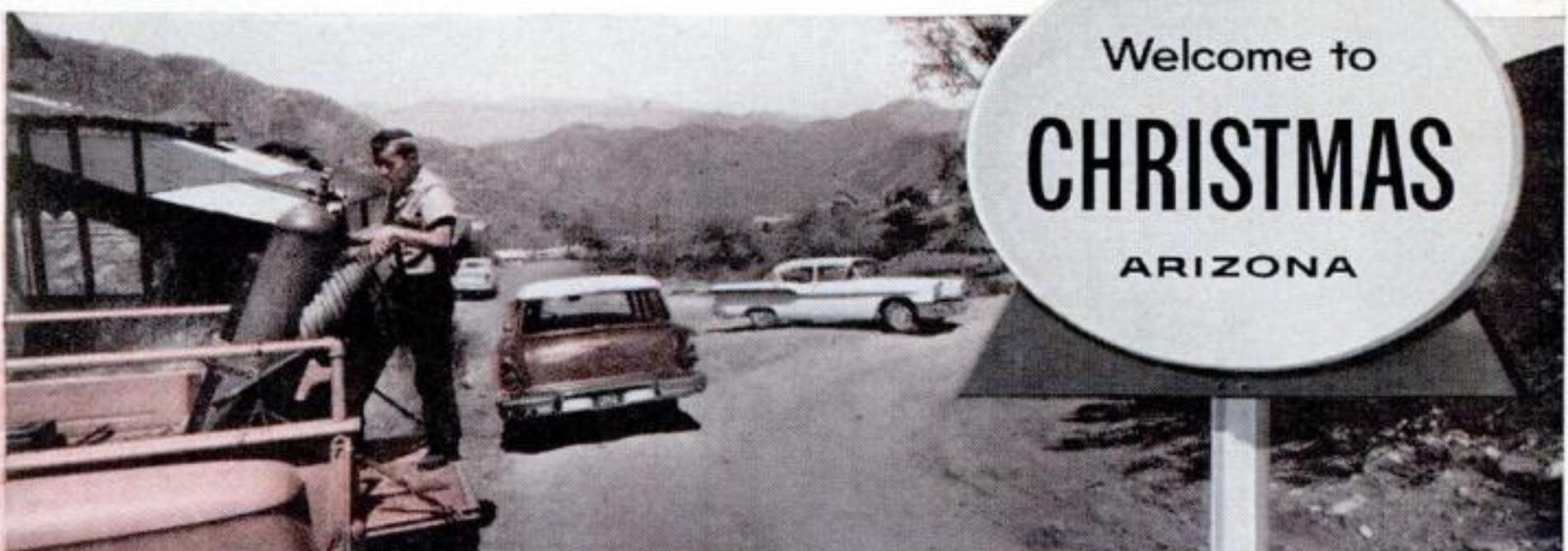
"Sounds like a challenge," Gus said as the man walked away. "How about the points, Bill?"

"Okay, but let me try again now that it's rested." He pulled the rope. A couple of splutters—then *pfft!*

"I see you put in a new plug," Gus said. "The way I figure, a gas engine has



FROM **Allgood to Christmas**  
1647 MILES—82¢



***For less than 1/20th of a cent a mile, a new AC  
Oil Filter keeps oil clean, protects your engine!***

If you're an average driver, you'll travel over six times the distance from Allgood, Alabama, to this little mining town of Christmas, Arizona — a total of 10,000 miles each year! Your car's engine must endure every type of driving, any of which can affect its performance and efficiency.

Engine parts are as precisely machined as a fine watch! That's why it's so important to give them the low-cost added protection of a new AC Oil Filter every 5,000 miles. An AC Oil Filter cleans all of the oil in the engine every 30 seconds at normal speeds — protects the precision parts from possible damage by dirt, dust, grit and bits of metal as small as 1/100,000th of an inch.

So, the next time you change the oil in your engine — change to a new AC Oil Filter, too! Your nearby AC Dealer will tell you how little it costs, how much it does for your engine.

**CHANGE OIL AND FILTER, TOO!**



Watch Walt Disney Studios' ZORRO every week — ABC-TV

AC SPARK PLUG  THE ELECTRONICS DIVISION OF GENERAL MOTORS

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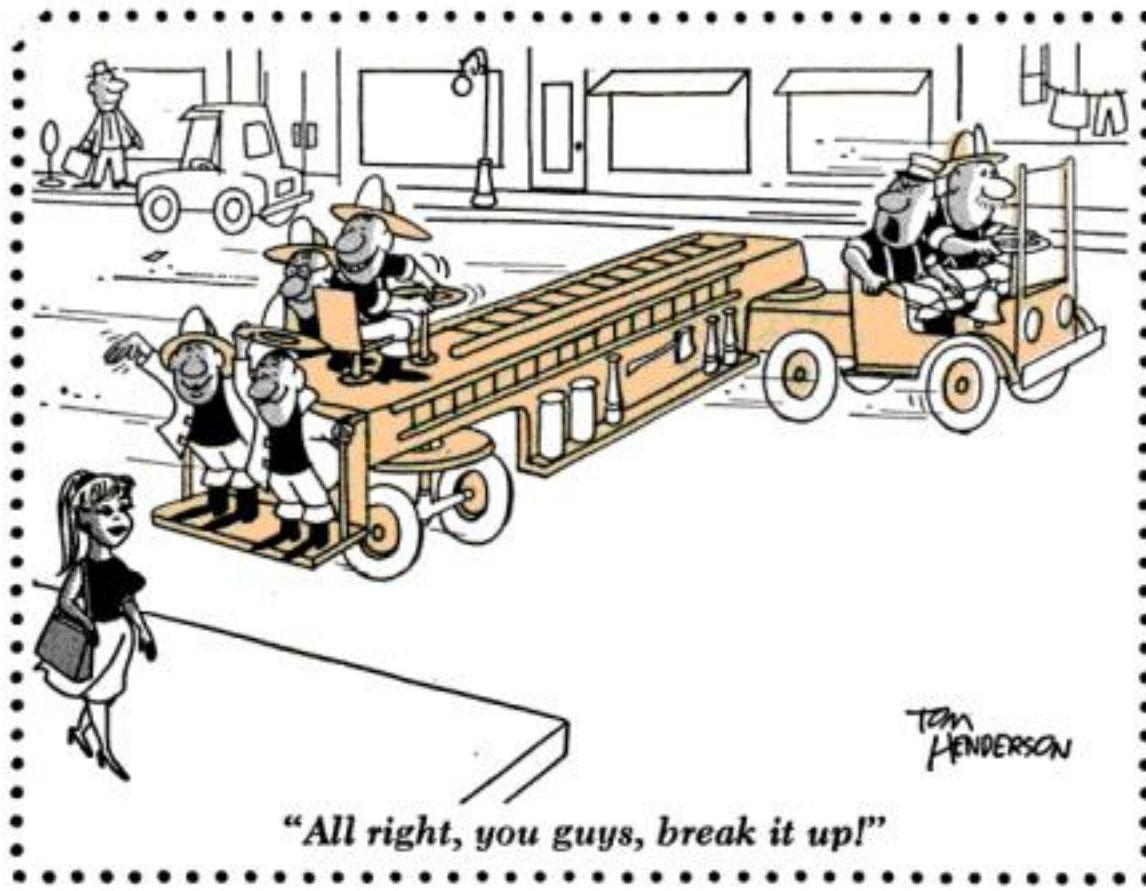
to run if it's got enough gas and enough spark." With that he plunged in with both hands. "The carburetor screens and jets are clean." He checked timing, camshaft and gears.

"I'll run through the valves. Four-cycle engines sometimes balk."

"Gosh, Mr. Wilson," Bill said, "we've only got 15 minutes. What'll I do?"

Ted Miller walked by with a cone of cotton candy. "Have another, Gus," he invited, "or is your windpipe still clogged?"

Gus looked up and scratched his head. "By golly," he said, "maybe that's it." He stooped down and disconnected the muffler. Then he grabbed the starter rope and yanked. The mower engine exploded



into life like a hundred eager firecrackers.

"Bill," shouted Ann, "he's fixed it!"

"I haven't, but you can easily enough," Gus said, holding the muffler up to the light for Ann to see.

"My heavens," she gasped, "what do you know about that?" She took up a screwdriver and poked a wad of cotton out of the muffler.

"If that doesn't beat everything," Bill said. "Now, whatever made you think of that?"

"Guess it was that cotton candy I choked on that gave me the tip. But we'd better get that muffler back on if you want to make the competition."

As Ann hopped into the station wagon Bill and Gus lifted the mower into the back. They got to the demonstration area

just as a loudspeaker was announcing: "And now, folks, the final demonstration, the Perfection Power Mower."

Bill got his machine down and pulled the starter. As the motor purred, he described its features over the public-address system. Then he put it through its paces, finishing his cutting right in front of Gus and Ann, in the grandstand.

A FEW minutes after Gus returned from the Park Commission meeting, the announcer's voice came over the air. "The judges have reached a decision. The contract goes to"—he paused and looked down at a piece of paper—"to the Perfection Power Mower."

"We're made!" shouted Bill as he hugged Ann and clapped Gus on the shoulder.

"You did a good job, Bill," Gus said. "And now I've got to see a man about his conscience."

At Ted Miller's stand he bought a double-sized ball of cotton candy, and headed toward the power-mower tent. The disgruntled Trail Blazer man was packing his gear.

"Say, mister," Gus said, "I think you deserve a consolation prize." He thrust the candy into a flabby hand. The guilty expression on the man's face cleared up any doubt Gus might have had as to how the wad

of cotton waste had gotten into Bill's mower.

"I don't get you," the man said.

"I think you do," Gus snapped. "You've got a nice clean mower there. Why play dirty with it?"

He turned and walked back to Bill and his pretty wife. Ann took his hand.

"How can we ever thank you, Mr. Wilson? You know . . ."

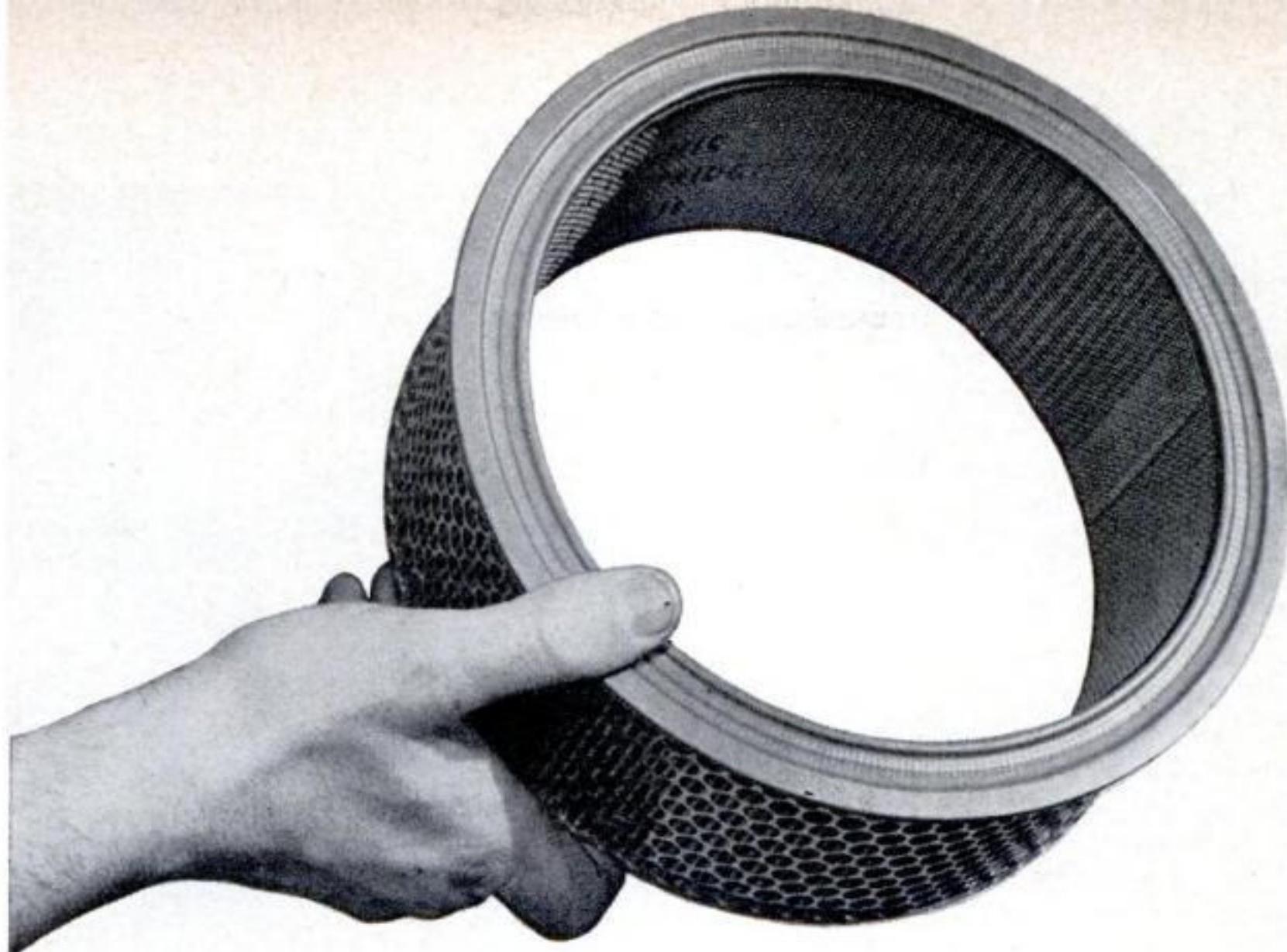
Gus interrupted her, a twinkle in his eyes. "All this somehow reminds me of an old saying."

"What's that?"

Gus stroked the button on his coat. "A stitch in time saves nine. In this case the stitch saved an order for nine power mowers."

END

**Next Month: Gus makes the right contact.**



# The Facts About Dry Air Cleaners

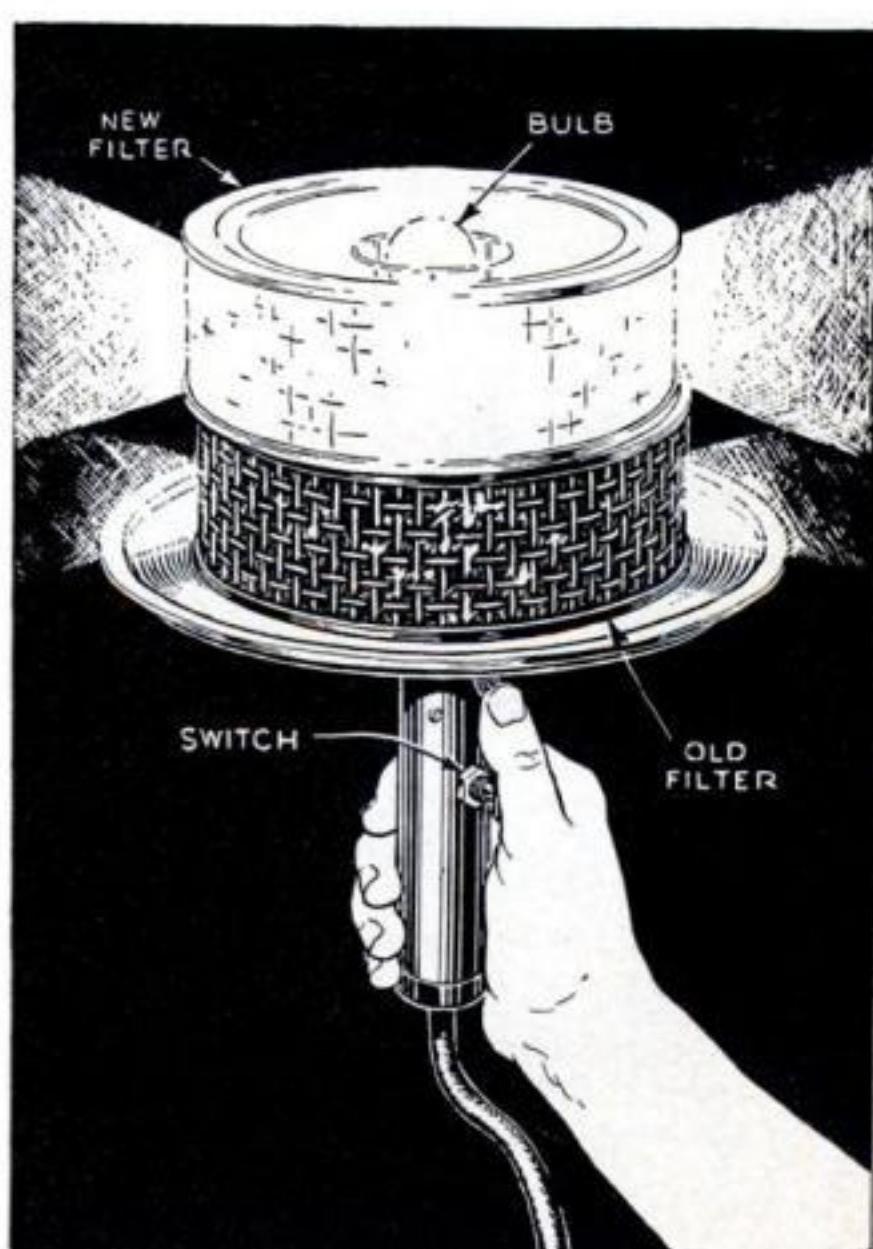
By Erik H. Arctander

**T**HAT pot of oil that used to sit on top of the carburetor isn't being missed. Paper now is filtering dust out of the air used by modern car engines—and doing a better job of it.

The new paper filters—called dry-element or “bone-dry” filters—have proved their worth over several years on the road as standard equipment on several car makes. In 1958, they’re standard equipment on major American makes, except Chevy—and GM’s thinking of making it unanimous.

Their big advantage, aside from more efficient filtering, is that they’re easy to maintain. You don’t need a pail of sol-

**CLEANERS CAN BE TESTED** with equipment found in many service stations. This tester illuminates your filter and a new one of same type to compare amount of light transmitted. If clogged, your filter will appear darker than new one. Tester also shows up pin-holes and tears in paper.



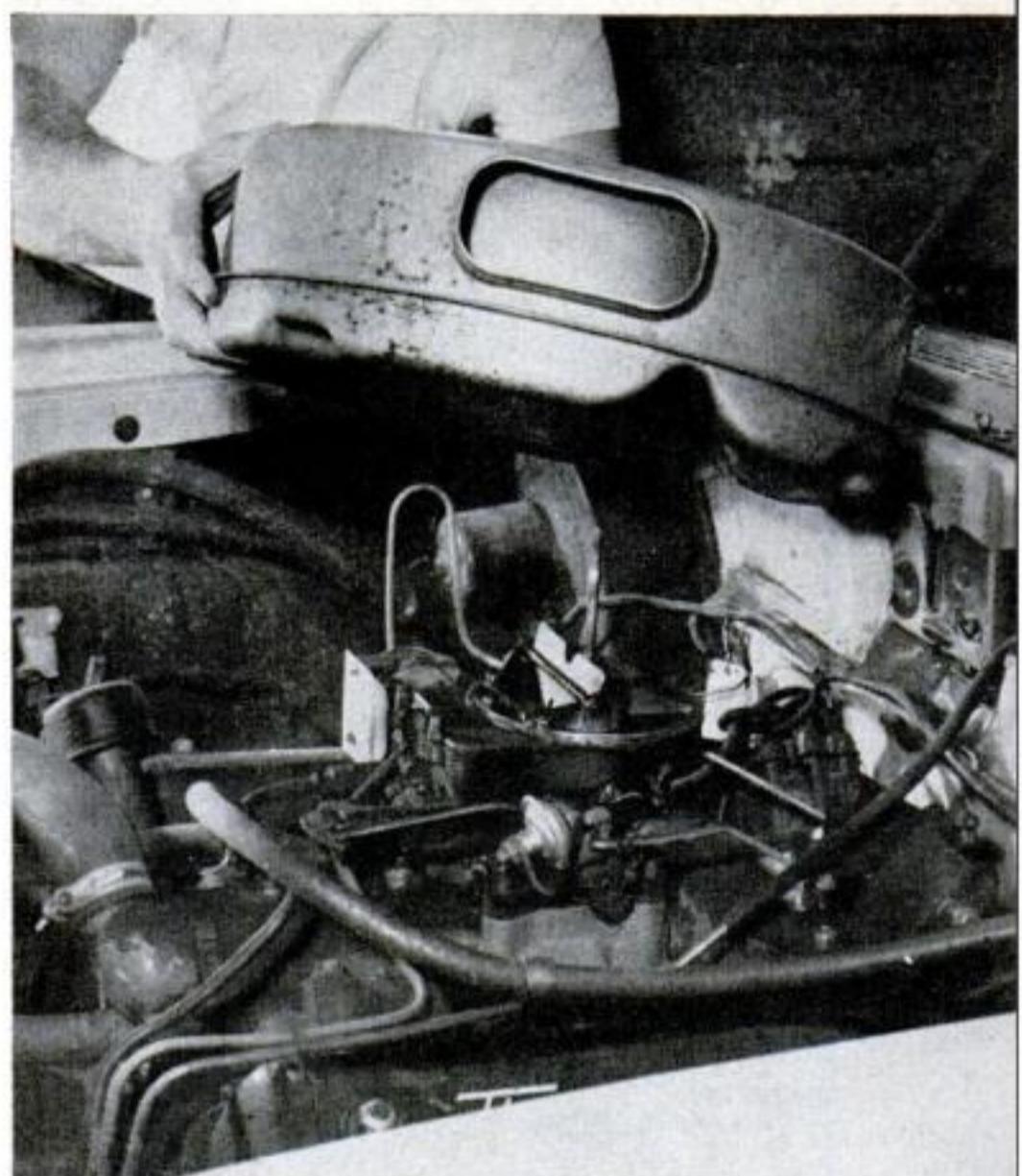
vent to dunk them in; just tap them on the sole of your shoe and the dry dust falls free. That's easy maintenance.

**How does a paper filter work?** Chemists have been using paper filters for decades to screen out minute impurities in solutions poured through them. The resin-stiffened paper air filters used in cars work on the same principle. It's almost unbelievable, but a filter will pass a large roomful of air through it every three minutes—that's what's needed to fire 250 horsepower—yet stop cold a dust particle as small as one micron (39 millionths of an inch).

In statistical percentages, paper filters are said to keep 98 percent of all airborne dust out of the engine, compared with the respectable but definitely second-place 85 to 90 percent kept out by oil-bath types. Oil-wetted filters (now almost obsolete) gave a pass to 50 percent of the dust, and that's a lot; ask your wife, who daily removes 100 percent of the airborne dust from the mahogany credenza.

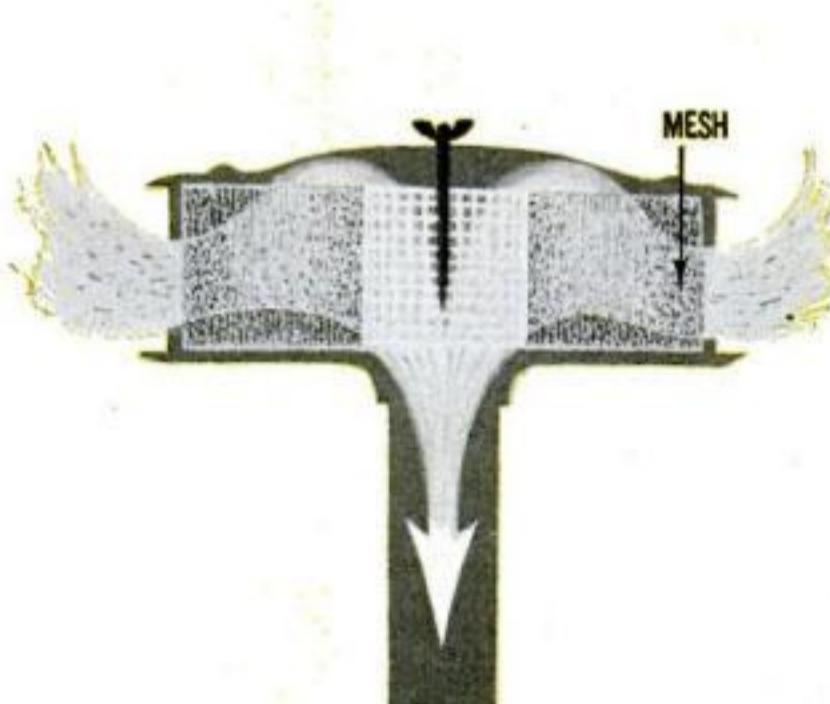
Why bother about filters at all? Looking at the exterior of the average engine, you'd think dust was the least of its worries. But inside is where the damage is done. For a grueling dirt-track stock-car race, three Chrysler 300s were equipped with paper filters and three with the oil-

## Forget buckets, solvents and oil

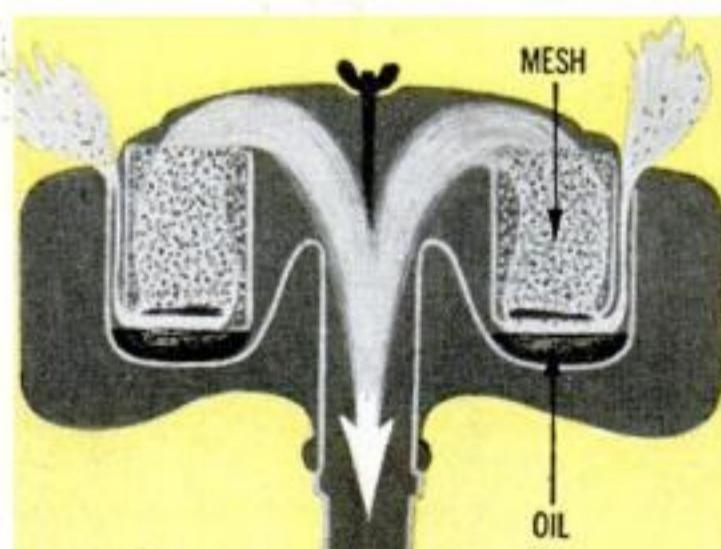


TAKE OFF THE AIR CLEANER by unscrewing the wingnut on top. If you remove only the cartridge, as some filter makers recommend, you might accidentally knock dirt off it into the throat of the carburetor directly below.

## The evolution of carburetor air cleaners



**OIL-WETTED TYPE** (now practically obsolete) was the first real attempt at trapping dust. Air had to pass through a layer of oily metal mesh, which caught dust particles like fly-paper if they happened to make contact. Its efficiency was poor—50 to 75 percent.



**OIL-BATH TYPE** worked on the theory that dust would be thrown into an oil sump as rushing air made a sharp upward turn around a baffle and through a mesh filter. Air-draft and slop action kept the mesh wetted with oil from sump. Efficiency—85 to 90 percent.

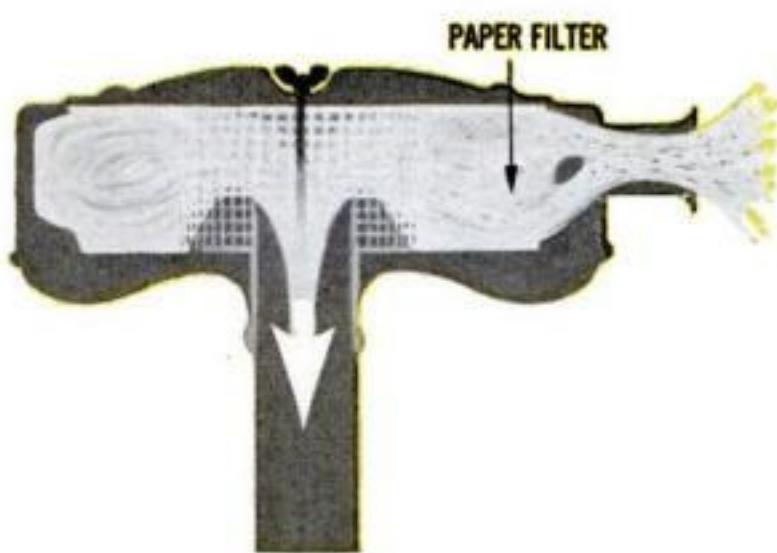
## —servicing a dry-element air cleaner is a breeze



**DROP OR TAP THE FILTER** against a solid object until no more dirt falls out. If the paper is heavily caked, use a low-pressure air hose held 2" from the *inside* filter surface. Don't wash in solvent; the paper might disintegrate.



**WIPE THE HOUSING CLEAN** before replacing the filter. Engine vibration in service tends to drop dust to the bottom. When installing the cover, tighten the wingnut securely to press the soft filter seals flat against the metal.



**DRY-ELEMENT TYPE** is sealed at top and bottom by soft gaskets. Air must pass through paper filter. Pleating permits packing yards of paper (750 to 1,000 sq. in. of filter area) into a small-diameter air cleaner. Makers claim 98-percent efficiency.

bath type. Engine-part dimensions were checked before and after the race. Cylinder wear from abrasive dust on paper-protected cars was  $2/100,000$  of an inch, compared with  $30/1,000$  wear on oil-bath-protected engines, and a resulting compression drop of 40 pounds. This convinced the car manufacturers.

**How often should you change filters?** Depends upon the roads you drive. On dusty rural terrain you may have to jar off the dirt every thousand miles, and replace the filter every five to 10,000 miles, when the paper becomes too choked to be cleaned. Rolling over paved highways and city streets, cleaning can stretch to 5,000-mile intervals and change to 20,000. Many service stations are equipped with a gizmo that quickly checks the paper filters.

Many drivers will wonder whether they can switch from oil-bath to paper filtration on older cars. They can. Conversion units are available at a cost of about \$18.

END

# 5 Extra Uses for Auto Floor Mats

---



1

**1 Stop a typewriter from "walking"** away when it is being used on a smooth surface. A mat underneath the machine will not only halt the creeping, but deaden the noise of typing.



2

**2 Catch small parts** that may drop out of a radio or TV chassis while you are working on it. They'll be trapped safely in an auto floor mat that has webbed grids. It will pad the chassis, too.



3

**3 Before starting a repair job**, take a tip from the surgeon who has all his instruments neatly laid out before an operation. An auto floor mat serves as a handy tool tray, makes selection easy and speeds up the job.



4

**4 Locating a small item** of hardware is easy. Nails, screws and such dumped on a mat can be spread out for selection of the wanted item, then simply funneled back into the container.

**5 Standing on a car floor mat** when operating power tools serves a double purpose. It provides a nonskid surface and insulates the operator from possible electrical shock.



5

# How to Back a Boat Trailer

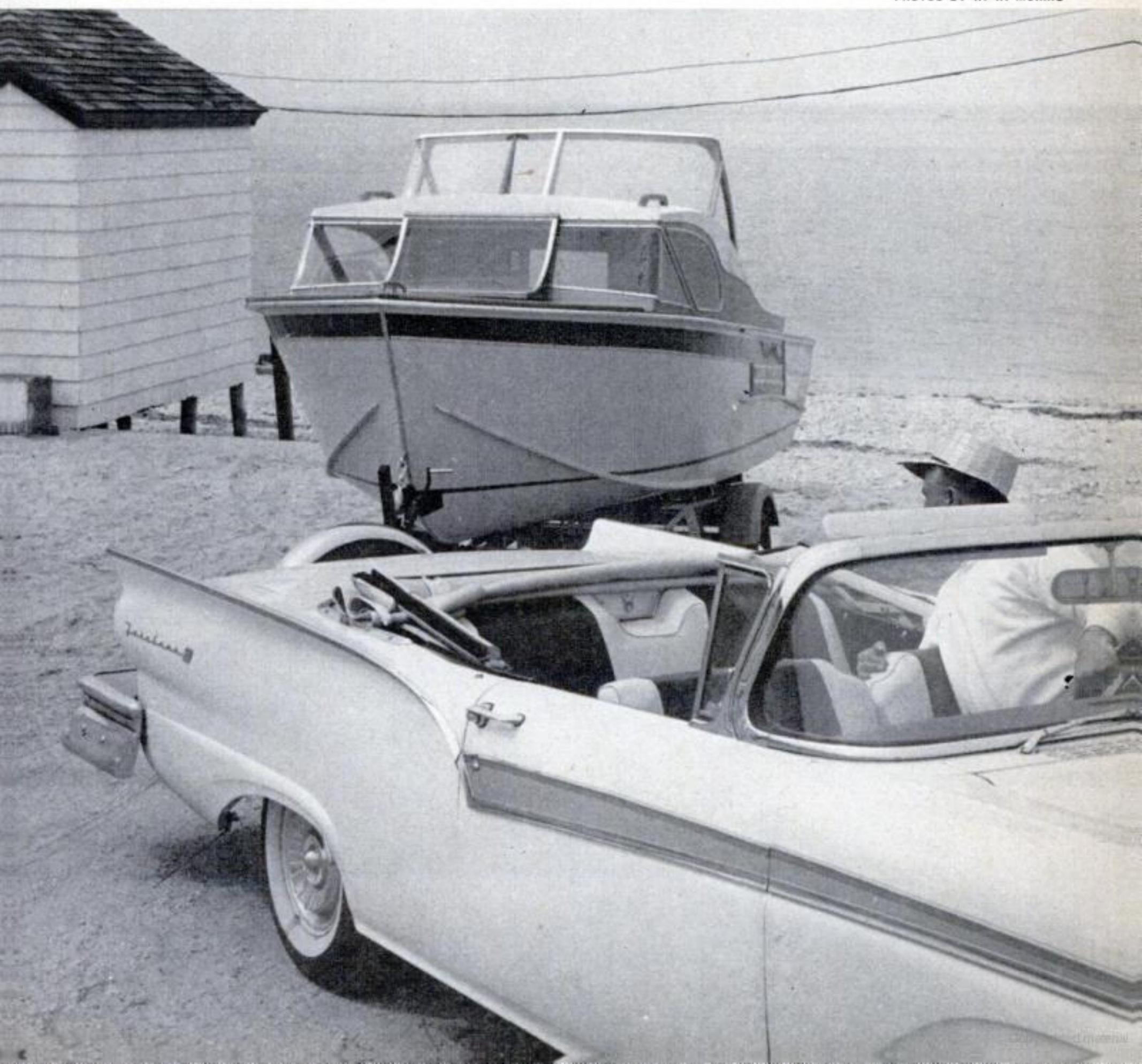
By Herbert R. Pfister

THE first time you back up a car with a trailer attached, the experience can be humbling. Actually, though, trailer backing is a simple sequence of four basic maneuvers: *setting up, breaking, following and (proudly) finishing* precisely where you wanted to go.

The trick is to reverse normal driving reflexes—do the opposite of what you do

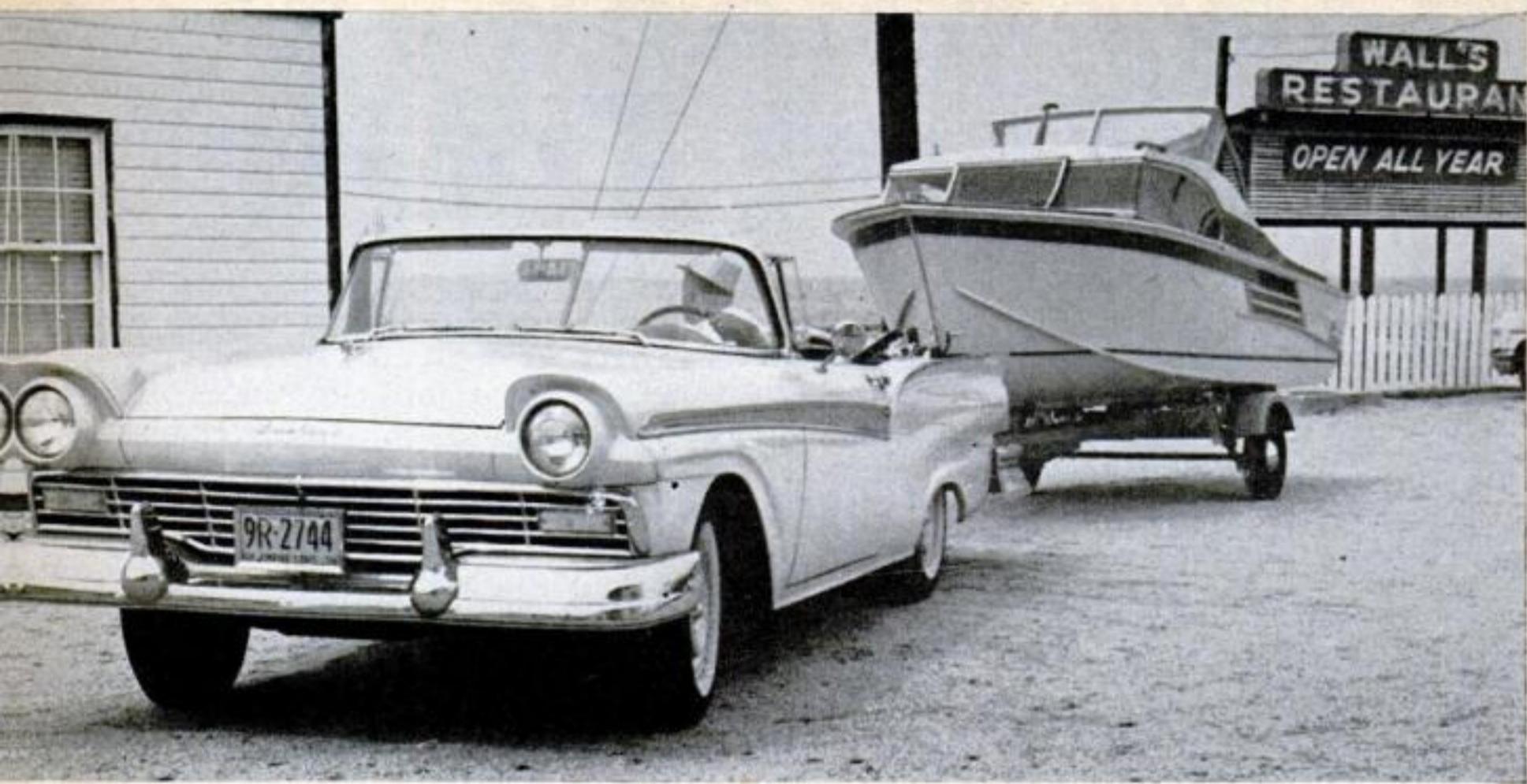
when you back your car alone. To start a trailer back to the right, steer hard to the left to *break* its alignment with the car, then quickly steer right to get the car behind it and *follow* it back. It's like balancing a broom on one finger. If the upended head drifts right, you move right to get under it and keep it in line. Similarly you must keep the car squarely aligned with the trailer to back it straight. Pictures on the next five pages show you how.

PHOTOS BY W. W. MORRIS

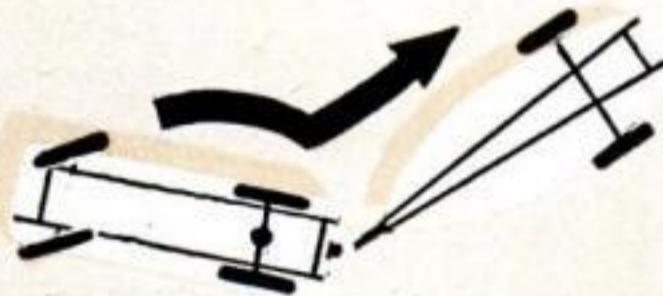
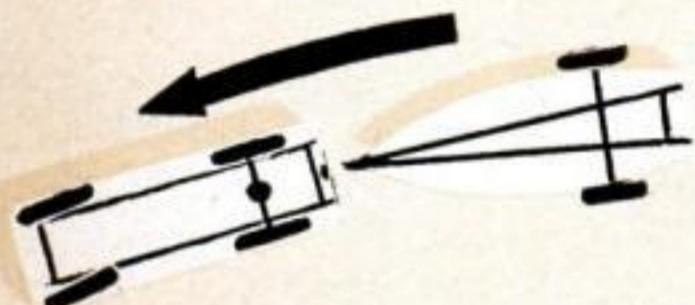


**The four basic maneuvers . . .**

**Setting up, breaking, following and finishing**



**1 SETTING UP** the rig before starting to back can save much maneuvering. Generally, it's best to drive past the spot you must enter, then steer away from it (to the left in the situation shown here). Stop when the trailer has passed the spot and is angled toward it.



**2 BREAKING** is the first step in backing. Cut hard to the left to make the trailer break to the right as you go slowly back. Put yourself in the driver's seat to visualize left and right. To back the trailer to the left, reverse all maneuvers shown in this sequence.





**3 FOLLOWING:** When trailer is almost aimed at entrance to launching ramp or driveway, swing the wheel to the right to make car follow trailer along an arc. Caution: Start following too soon and you'll overshoot. Wait too long and you'll probably jackknife or cut the corner.



**4 FINISHING** often brings a sigh of relief. But stay alert. Backing straight requires constant manipulation of the wheel to overcome the trailer's tendency to wander. If it drifts to right, steer right to straighten it, then follow. Steer left to correct it if it starts to drift left.





### **Bad start? With room, you can still correct it**

**YOU'VE CUT TOO SHARP!** Heading for the pole! You can stop, pull ahead and start over, but if you're trying to impress an audience, and if you aren't too close, you can snake your rig around the pole and correct the situation with finesse. Pictures at right show you how.

**BREAKING TOO SOON** to the left on the approach, or waiting too long before following, caused the trouble, so *break again*—cut hard to the right—to get out of it. Easy does it—you'll have to back slowly and steer quickly to maneuver efficiently in a tight spot like this one.



### **Tight spaces call for tight maneuvers**

**A NARROW STREET** and parked cars make setting up at an angle impossible. Pull up past the driveway and on your side of the street. Where space is tight, or when you're backing on a street where children are playing, always station a lookout at the rear of the trailer.

**BREAK HARD**, cutting full to the left—almost to the point of jackknifing the rig—to start the trailer into the narrow driveway entrance. Tip: You'll appreciate power steering, especially when you have to whip the wheel from one hard-over position to the other.



**CUT QUICKLY TO THE LEFT** the instant the boat's stern clears the pole to again *break* the trailer in the direction of the launching ramp. Keep one eye on your car's rear fender to be sure it clears the pole, while you watch the trailer swing around toward the ramp. Slow is the word at this point. You're going to have to change direction in just a moment.



**AS THE TRAILER ENTERS THE RAMP,** whip the wheel right to bring the car into *following* position. Then straighten the wheel slowly as the car aligns itself with the trailer (timing is crucial: Straighten out too soon, the trailer will jackknife; wait too long, it'll take a tack to the left). Now follow the trailer down the ramp —you're headed for the beach.



**FOLLOW THE TRAILER** up the driveway, steering hard to the right to swing the car in after it. When the area of operations makes for as narrow a squeak as this, don't waste precious inches of backward travel while steering. Whenever you must change direction in tight quarters, stop backing at the crucial moment, turn the wheel to the correct position and then proceed.



**ALL YOU HAVE TO DO NOW** is back straight up the driveway while keeping the trailer centered. At this point in your maneuvering, no one will raise an eyebrow if you need more than your share of the road. It's only for a matter of seconds. Pull out across the street to align the car with the trailer and straighten the entire rig before you start backing up the driveway.

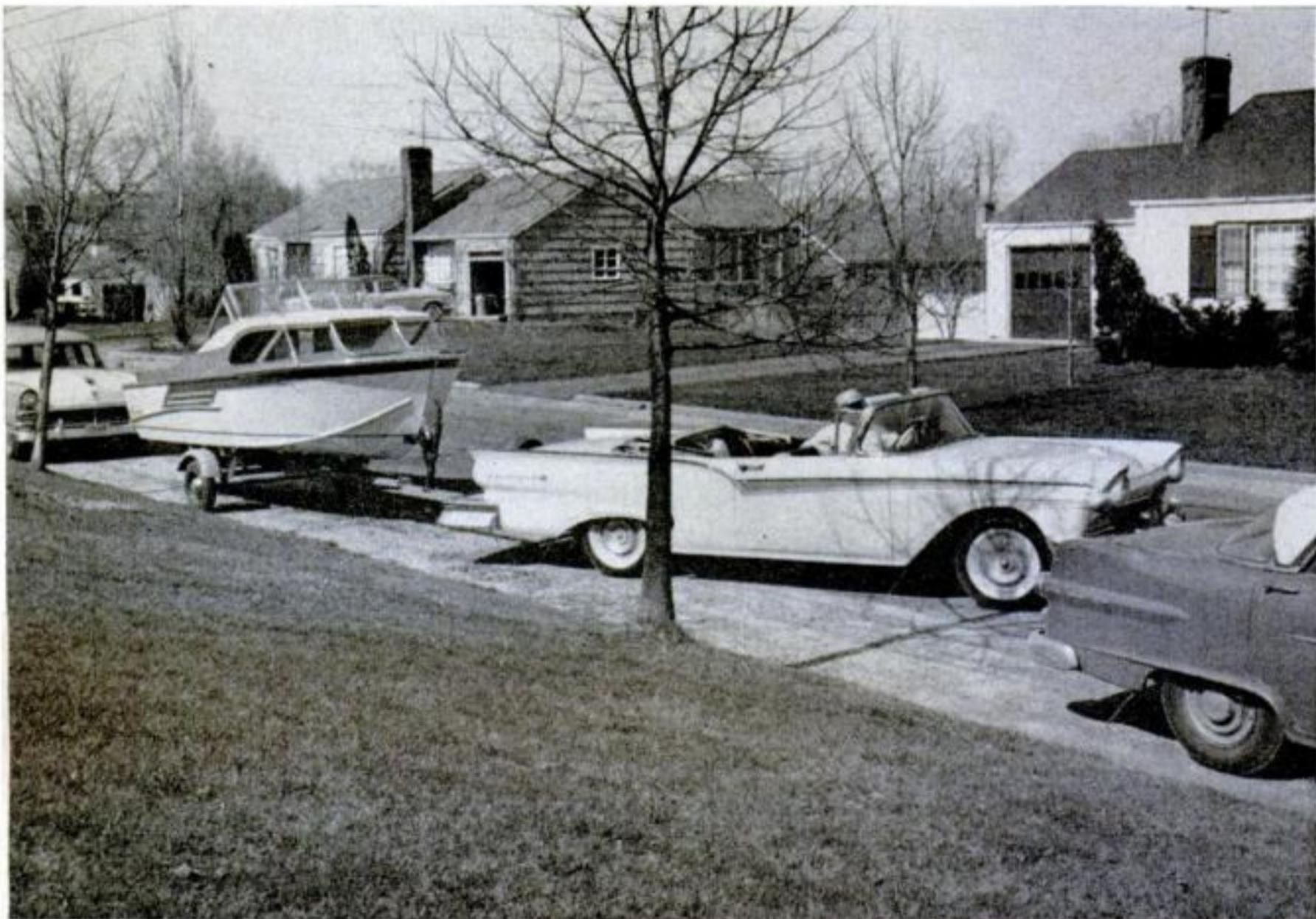
## If you can park your car, you can park a trailer



**PARKING AT THE CURB** is a flashy maneuver, but it's easier than entering a driveway. Size up the space to be sure it's long enough for the trailer and car. Then pull forward until the trailer is abreast of the car parked ahead of the space, and about three feet out from its side.



**CUT LEFT** and go back a few feet to break the trailer's alignment and start it into the space. The front of your car will swing close to the parked car, so divide your attention between the trailer and your right front fender. Next, cut your wheel to the right and follow.



**EASY DOES IT!** Follow the trailer back until it reaches the curb, then swing the wheel to the left to snuggle your car's front end into the space. If the sun is on your right, you're in luck.

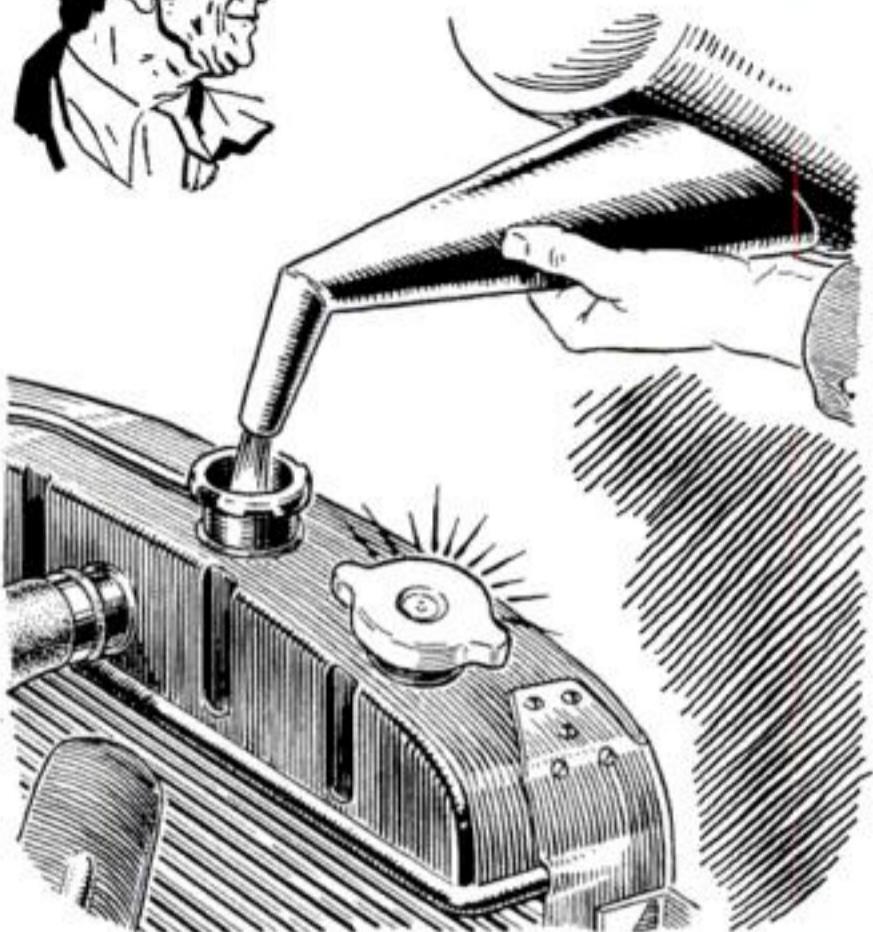
By merely watching the shadows on the pavement, you can simplify your job considerably—they'll tell you precisely how much space remains behind the trailer.

END



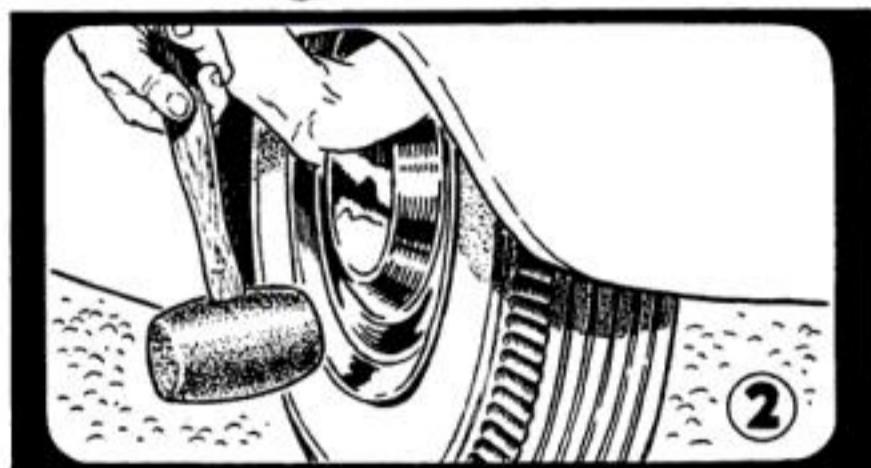
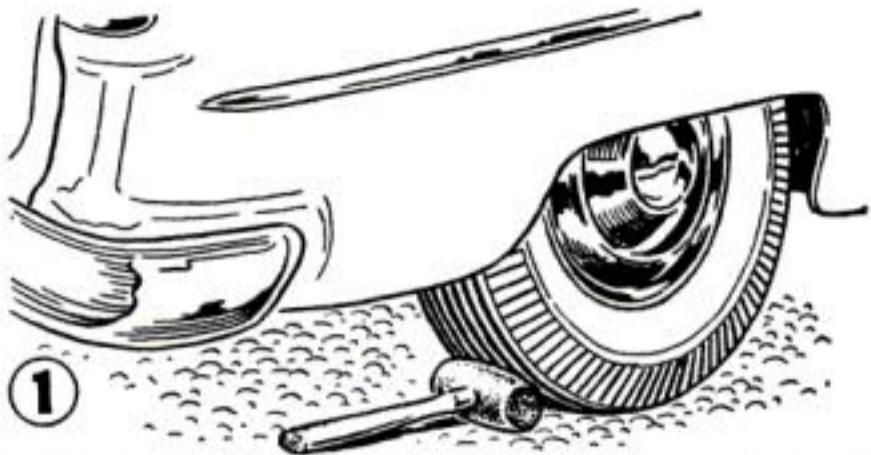
## Hints from the Model Garage

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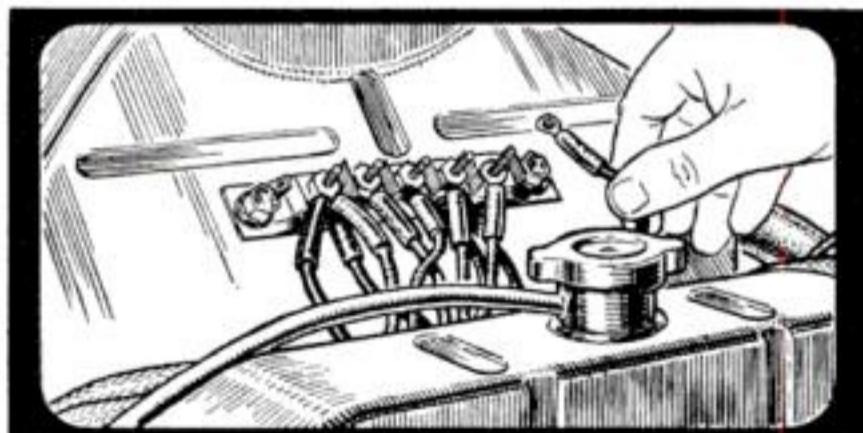
**Your radiator cap** is less likely to be left unnoticed after the coolant has been checked if you paint it bright yellow. Paint the underside, too (but not the pressure seal), to make it conspicuous even if it is set aside upside down.

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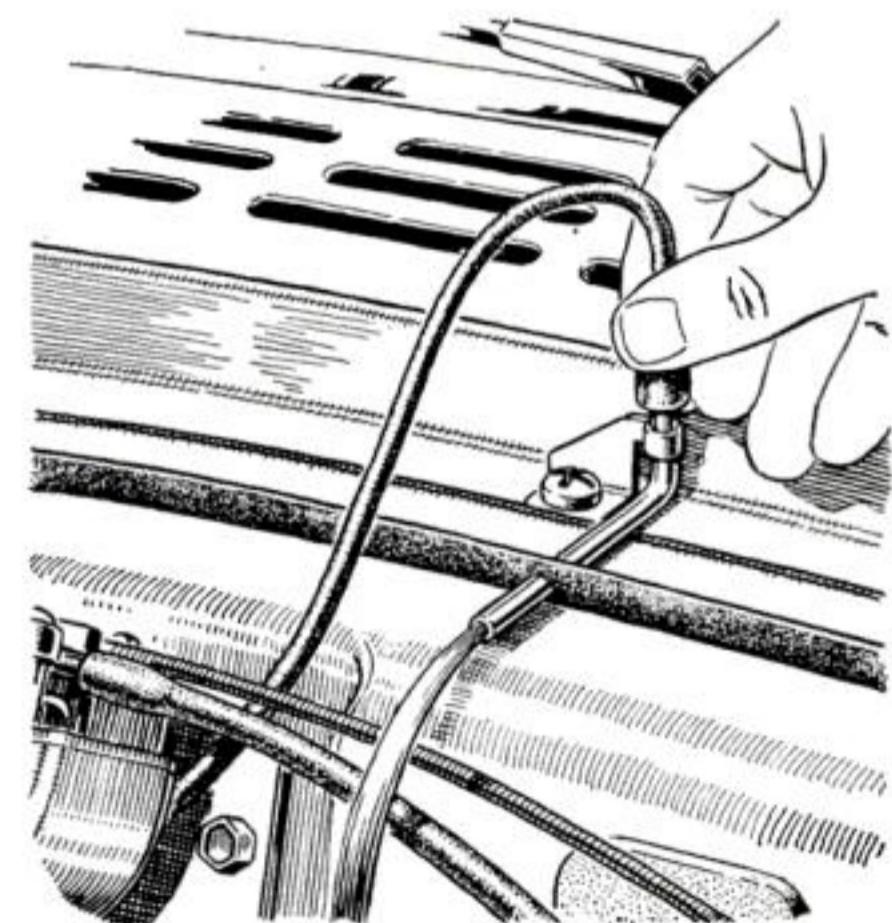


**A rubber mallet** is useful in two ways when you change a wheel: Place it under one of the other wheels as a safety chock to keep the car from rolling; when the job is done, pull it out by the handle to use it for driving on the hubcap.

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**If a headlight burns out** on both filaments, you can temporarily connect a parking light to the headlight circuit to show oncoming drivers the width of your car. Switch wires at the junction block, usually located behind the grille.

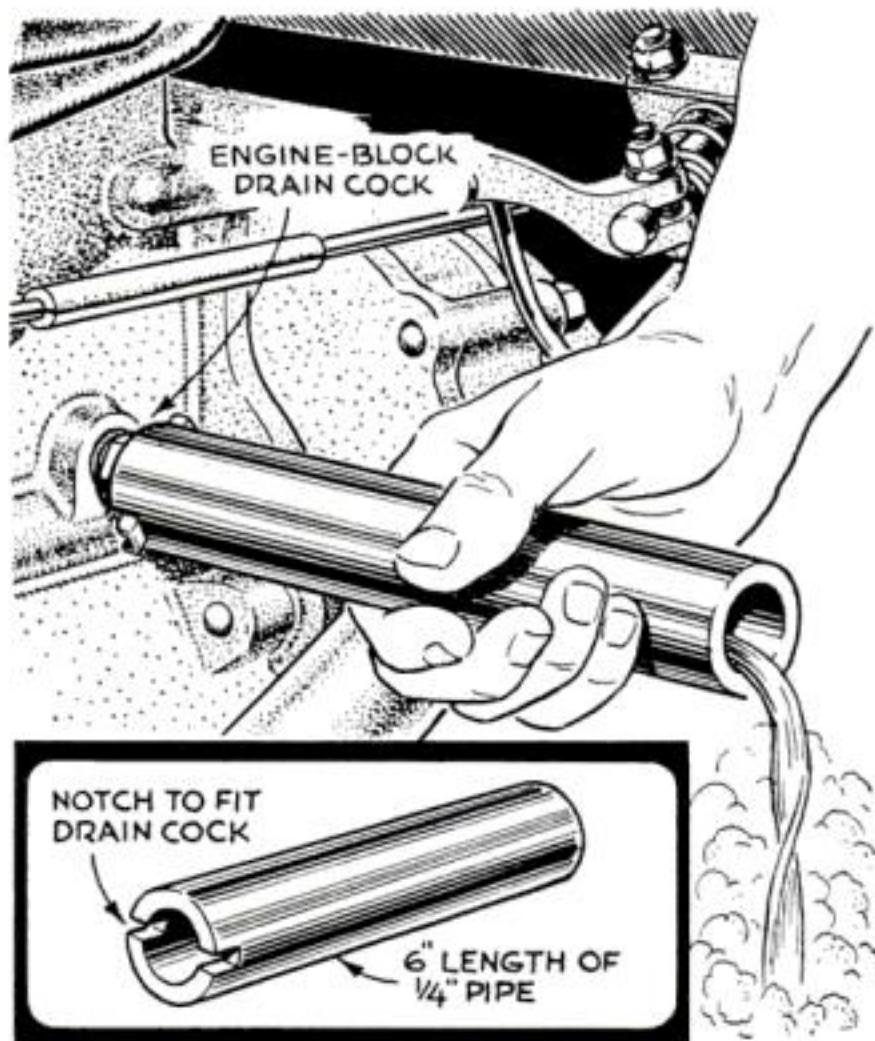


**Windshield washer won't squirt?** First, be sure there's water in the reservoir. Then disconnect the tube at the washer nozzle and slip it over the discharge end. Operate the washer a few times to reverse-flush the nozzle and clear it.

## More Hints from the Model Garage



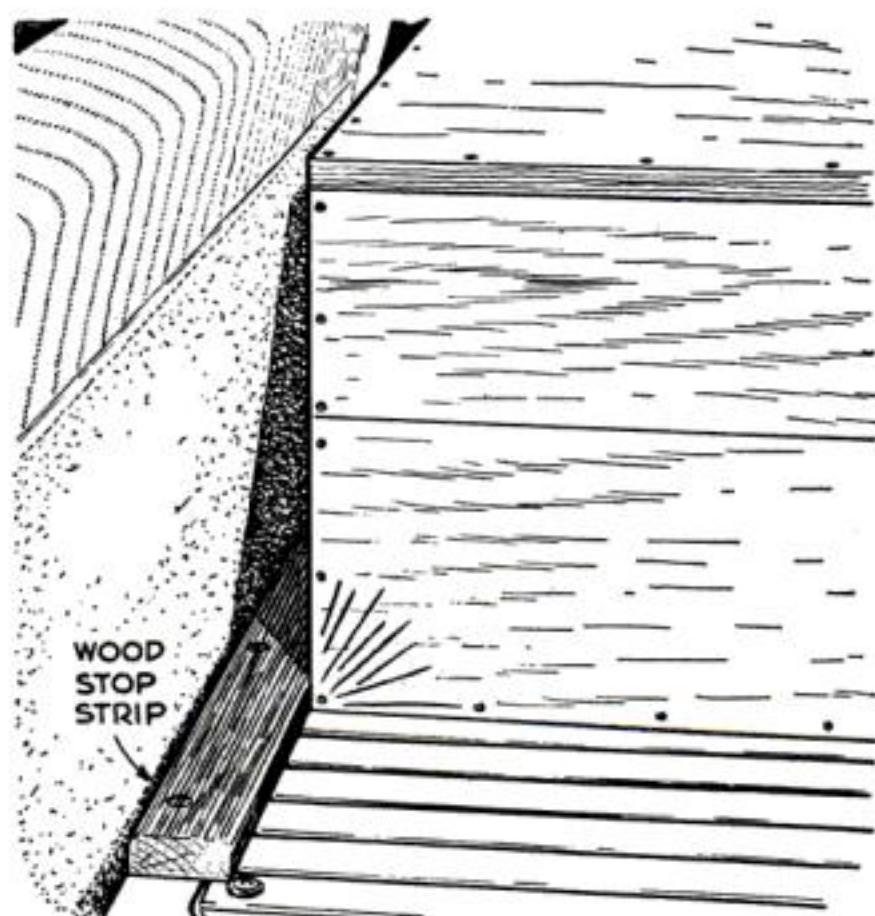
**Keep tail lights bright** by occasionally wiping dust from the bulbs and the *inside* of the lens. Your turn- and stop-signals will be unmistakably clear to drivers behind you, and some foggy night their brilliance may prevent a collision.



**A notched piece of pipe** will keep your hands from being scalded when draining coolant from a hot engine. Slip the notched end over the drain cock's T handle and twist. As the drain opens, hot water will flow through the pipe.



**Rust often starts** unnoticed where the bumper is covered by the license plate, then spreads rapidly outward. You can prevent this by protecting the chrome in that area with a coat of clear varnish before you bolt on the plates.



**A wood stop** or strip fastened to the deck of a station wagon, behind the front seat, will keep boxes and suitcases from slamming forward when the brakes are applied. Fasten the strip down securely with sheet-metal screws.

# New Roof Paint Keeps House Cool



**Brush-on aluminum coatings, now out in fancy colors, reflect heat, seal leaks and make old roofs like new**

**By George H. Waltz Jr.**

**T**AKE a few hours out on any broiling-hot Saturday afternoon and you can literally "paint on" a new, pastel-colored roof that will keep your house up to 10 degrees cooler inside. On a 90-degree day, this alone is enough to make the difference between reasonable comfort and unbearable heat.

The secret is in a new type of roof paint that contains thousands of tiny particles of aluminum. These particles reflect the sun's radiant heat away from your roof like thousands of tiny mirrors.

**New roof in a can.** Summer cooling is only one of many bonuses you get with this remarkable new roof coating. Developed by the Aluminum Company of America and already being made by more than half a dozen paint companies, the special formula delivers a four-barreled blast to make old roofs like new.

In addition to aluminum for insulation, the paint contains an asphalt binder that seals leaks in cracks and around nailheads. Asbestos fibers add strength and toughness to the coating. Fadeproof pigments, in many eye-popping pastel colors, add years of new beauty to a worn, drab roof. The same aluminum particles that reflect the sun in the summer are also said by Alcoa to help keep you warm in winter by bouncing some of the house's heat back inside instead of letting it escape through the roof.

**How long will it last?** Accelerated tests show that the paint will stand up for six to 10 years without losing its color, adhesion, weatherproofing or insulating qualities. The colors—bright metallic shades of red, brown, gray, green and blue—actually become more intense

**Consumer News**

with age instead of fading or darkening.

According to experts at Alcoa, the new paints "can save old or badly worn roofs and extend the useful life of a newer roof. Properly applied, they will give maximum weatherproofing protection—even under the most punishing conditions."

**A permanent roof?** This raises an interesting question. Could repainting your roof put an end to reroofing completely? Because the paint is so new, Alcoa engineers are understandably cautious. But they do believe that *if* you catch your roof while it is still in good shape and *if* you recoat it every few years, *you may never have to put on a new roof.*

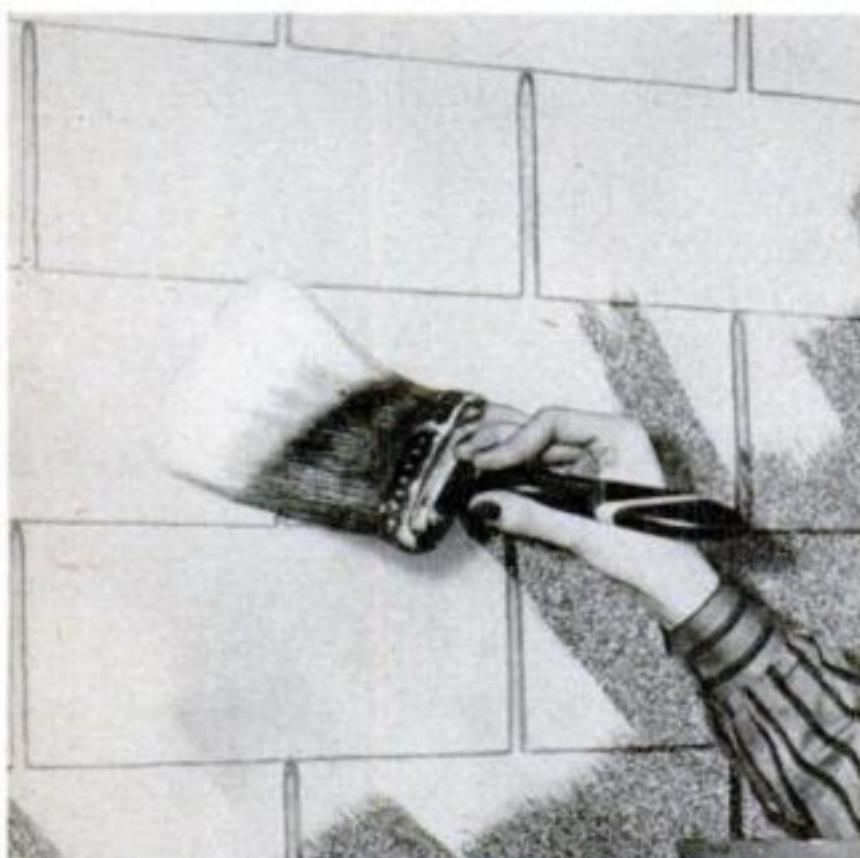
It is well known, for instance, that asphalt shingles do not *wear* out; they *dry* out. As the oils in the asphalt evaporate, the shingles become brittle and begin to crumble away. A new coating seals these oils in and helps to keep the original asphalt fresh, as well as adding a tough, new layer of asphalt.

**How the paint is used.** Called "colored aluminum roof coatings," the new paints can be applied to almost any type of roof surface—composition, asphalt, asbestos, even slate, tile, metal and concrete. The only exceptions are wood and a few materials having a coal-tar base.

You can apply the paints just about any way you want. You can "broom" them on with a regular three-knot roofing brush or use an ordinary paintbrush. If heavy-duty spraying equipment is handy



A fresh, colorful look—and years of life—are



**YOU CAN PAINT WALLS, TOO**—over asphalt or asbestos shingles, bricks and concrete blocks.

(or can be rented), it will do an excellent job and save time to boot. A thick-pile roller coater fitted with an extension handle also can be used if the surface is flat and fairly smooth. An ordinary roller, however, will not work too well on asphalt shingles because of the rough surface.

While the paints do a good job of sealing small cracks, they can't be expected to waterproof serious leaks. All large cracks and nail holes should thus be patched first. The roof should also be clean and dry when the paint is put on.

Otherwise, there's nothing finicky about it. You use the paints just as they come from the can. They spread quite easily, dry to the touch in about two hours and dry completely overnight.

Coverage depends on the type and con-



quickly "broomed" on with one of new aluminum paints. Most makers offer six to eight shades.

dition of the surface. A safe estimate is about 150 sq. ft. for a gallon.

**Price?** Most manufacturers are selling the paints at about the price of a regular top-quality exterior house paint—in the neighborhood of \$7 a gallon. With a coverage of 150 sq. ft. a gallon, this means the cost of refinishing the roof on an average six-room house—including insulating, weatherproofing and coloring—comes to about \$40.

Although the new paints are primarily designed as roof coatings, they can be applied to vertical surfaces such as siding and masonry foundations. They are particularly well adapted to use on stucco, concrete, cinder blocks, and bricks. They also provide the perfect combination for protecting metal surfaces: fences, poles and ornamental grillework.

END

#### **Who makes the paints**

Manufacturers of aluminum roof coatings are increasing rapidly. Among those selling the paints at this time are:

**Al-Chroma Paint Co.**, 705 Chamber St., Stevens Point, Wis.

**American Paint Corp.**, 3001 W. Superior, Duluth, Minn.

**Carter Paint Co.**, Liberty, Ind.

**Duncan-Stewart Industries, Inc.**, 225 W. 57th St., NYC 19.

**Klimate-Pruf Paint Co.**, P. O. Box 2755, Greensboro, N. C.

**Sheffield Bronze Paint Co.**, 17814 Waterloo Rd., Cleveland.

**James B. Sipe & Co.**, 115 Vanadium Rd., Pittsburgh.

**Thompson & Co.**, 1085 Allegheny Ave., Oakmont, Pa.

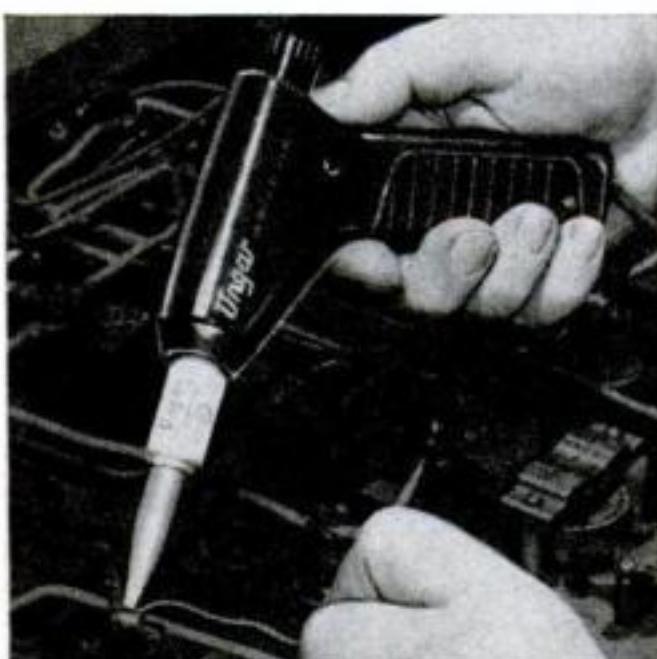
**Yenkin-Majestic Paint Corp.**, E. 5th at Leonard, Columbus, Ohio.

# what's new

## the latest in tools

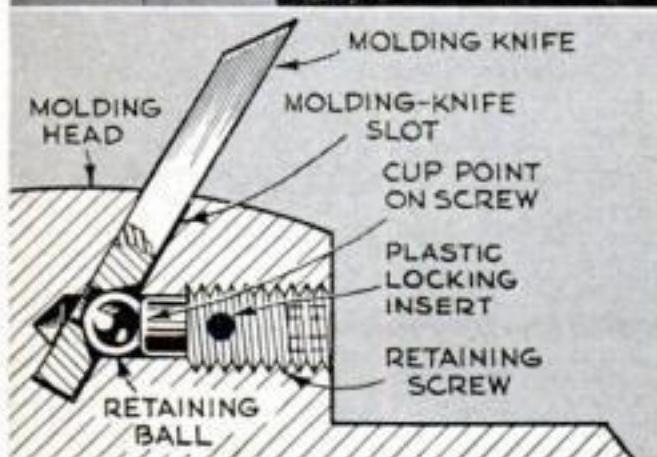
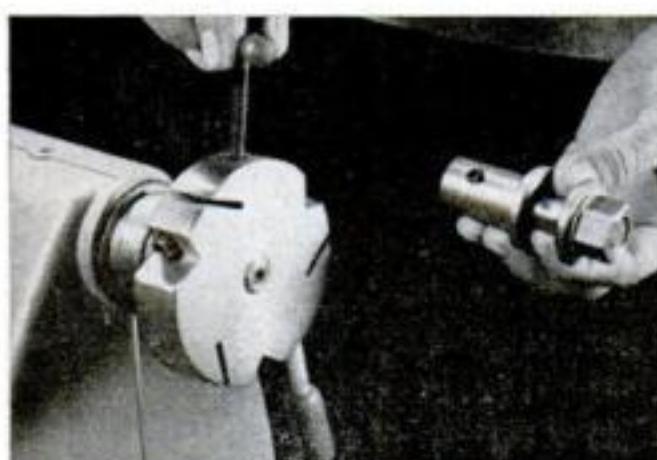


Need a quick, inexpensive electric drill? The adapter at left converts any kitchen mixer into a  $\frac{1}{4}$ " drill with a Jacobs key chuck. G. K. Stewart sells it with nine drill bits for \$4.95.



Electric handsaws are booming bigger than ever. Thor reports so much success with its earlier saw that it's bringing out two new, more powerful models, one at \$29.95 and another with full ball-and-needle bearings for about \$40. Both saws are rated a husky 3.1 amps, have built-in chip blowers, weigh only four pounds . . . A new saw-table accessory has also been announced by Sunbeam to convert its electric handsaw into a stationary saw. It will sell for about \$15.

Drills that convert to power drivers indicate a new trend. The latest ones at right, made by Millers Falls, take either a  $\frac{3}{8}$ " geared chuck for drilling or a full line of snap-in screwdriver bits and socket wrenches.



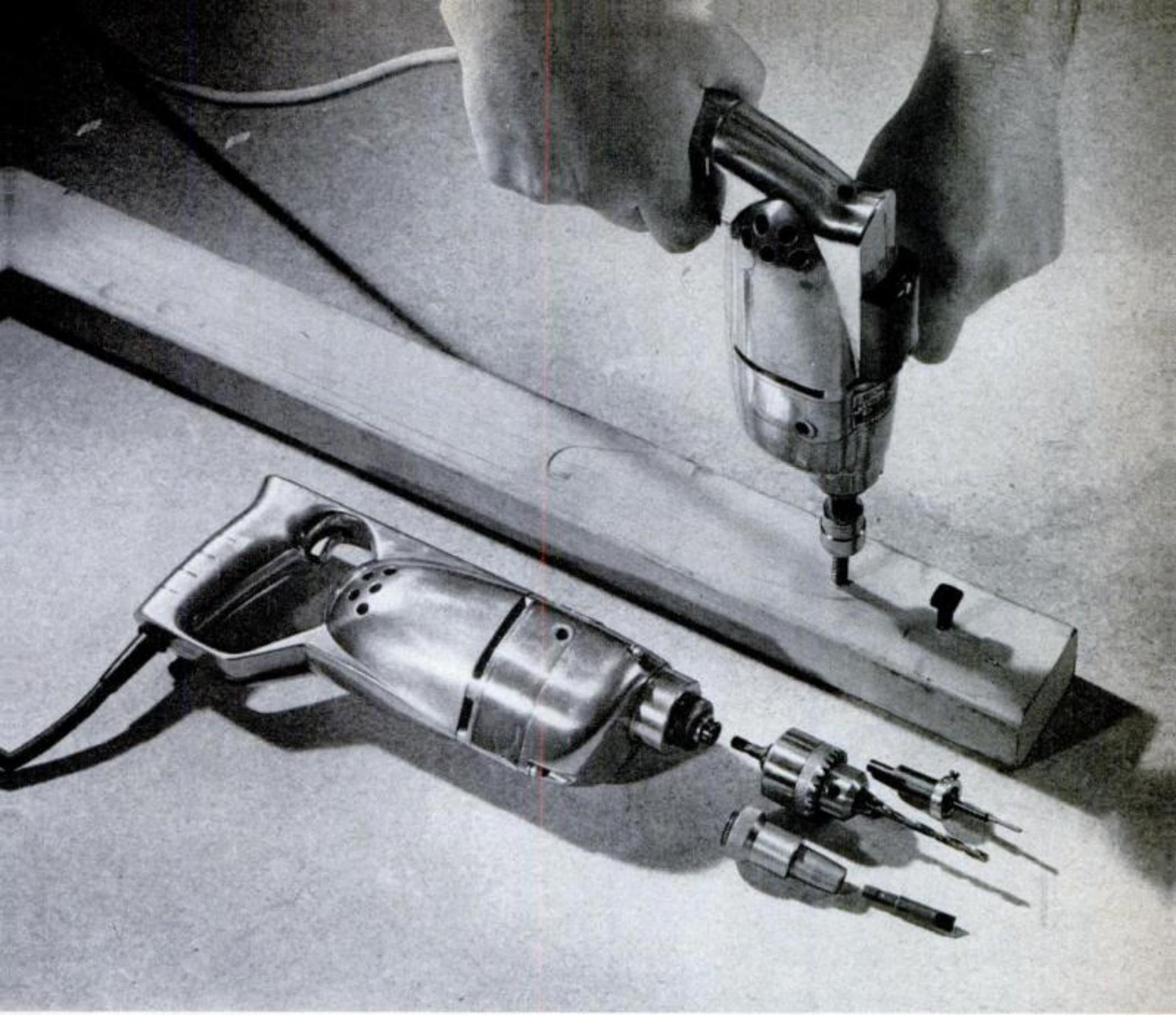
Under test by POPULAR SCIENCE, the 275-r.p.m. Millers Falls power driver drove  $\frac{3}{8}$ " lag screws into a two-by-four as if it were butter. A reversing switch also speeds removal of nuts or screws. Both models, with choice of pistol or saw-type grip, will sell for \$39.95.

Easier soldering in tight spots is the claim for the extra-long-reach gun at left. Its  $2\frac{1}{2}$ " chisel tip can be rotated for precise pinpointing of heat. The Ungar gun sells for \$4.50.

Eye-catching styling may play a bigger part in modern power tools. Evidence: a new  $\frac{1}{4}$ " electric drill that features a copper-plated gear case, aluminum housing and black trim. The 2.7-amp drill is made by Remington Arms and sells for \$29.75.

An ingenious locking device keeps molding cutters from loosening or shifting in the new molding head at left. It's made for the Magna Power Tool line by the Henry Disston Division of H. K. Porter Co. Price is \$7.95.

Each retaining screw drives a hardened-steel ball into a countersunk recess in each cutter, as shown in the sketch. Once in, the balls can't move and automatically force all three cutters to line up in exactly the same position. This produces dead-true cuts, especially important where two contours must mate perfectly.



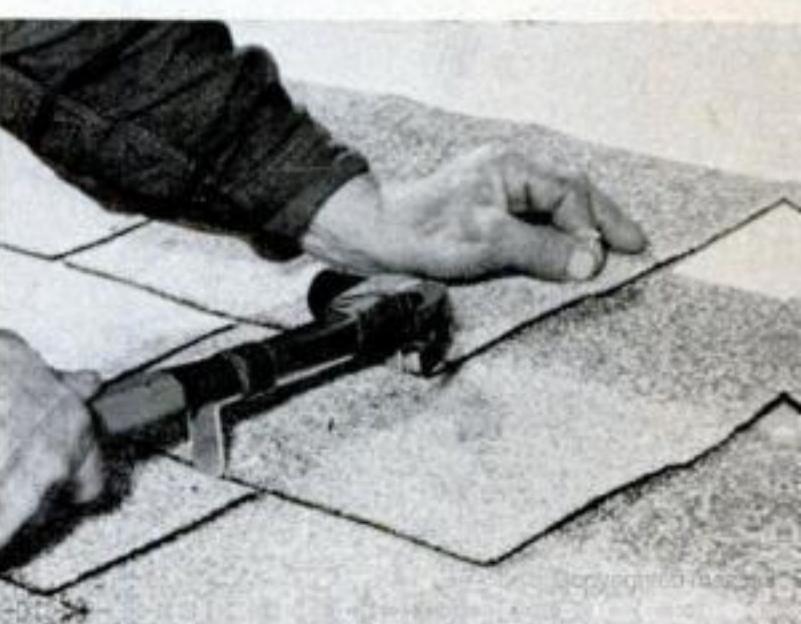
## for the home handyman

Low-cost fences, like the one at right, are a novel use for a new type of corrugated-steel roofing. The strips have crimped, flattened edges that are smooth, safe and decorative. Ceco Steel Products makes the roofing in 15" and 30" widths. Estimated cost for a three-strip fence: about \$1.25 per running foot including posts. And it needs no painting.

Colored aluminum paints, similar to those for roofs (see page 157), are now available in spray cans for indoor use and in a brush-on type for outdoor use on metal, wood and masonry. The Master Bronze Powder Co. makes both types in green, blue, silver and gold.

Accurate spacing of shingles is easy with a metal gauge that you tape to the hammer, as at right. Sure Simple Service sells it for \$1.

**More new products on the next page**





New paint roller at left feeds itself from a one-pint container attached to the handle. Pumping the trigger automatically forces paint up through the hollow handle, keeping the roller saturated. Damar sells it for \$8.98.

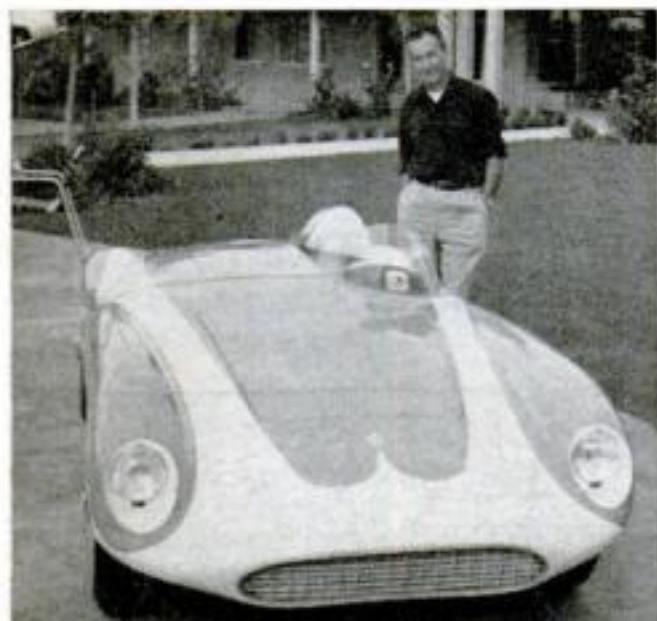
It won't make you feel any cooler, but you can tell how high the humidity is from an inexpensive, chemically treated card that changes color as moisture rises. Said to match the accuracy of costly hygrometers, the cards are made by Andrew Technical Supply for industrial or home use where humidity must be controlled.

## what's new for your car



The adjustable back rest at left is said to be the first to fit all the shapes and sizes that motorists come in, thereby providing greater freedom from backaches and driving fatigue. Made of glass-fiber mesh over a steel frame, it has three controls that let you adjust height, sitting angle and firmness of support. The Market Forge back rest is priced at \$12.95.

Two aids for station-wagon owners: A light-weight, aluminum fence divides front seat from rear cargo area to make a compartment for toting a frisky dog. It locks between the side windows and can be adjusted to fit all makes of wagons. It's sold by K-9 Products for \$29.95 . . . You can also pad your cargo deck with 2"-thick foam-plastic cushions. Made by American Latex, they come in a 43"-by-74" stock size for \$29.95 or can be custom-contoured to fit your wagon.



Growing popularity of the Volkswagen is shown by two new plastic sports-car bodies designed especially to fit the VW chassis.

The Devin model (upper left) costs between \$300 and \$400 depending on extras. The Alken (lower left) sells for \$1,295. Both bodies bolt directly to the chassis without alterations.

*Sheldon Gallager*



### for more information:

Here's where to write if you can't get any item listed on this or the preceding two pages: **Alken Corp.**, 2100 Zeno Place, Venice, Cal.; **American Latex products**, Hawthorne, Cal.; **Andrew Technical Supply Co.**, 7068 N. Clark St., Chicago 26; **Ceco Steel Products Corp.**, 5601 W. 26th St., Chicago; **Damar**, 128 Damar Bldg., Elizabeth, N. J.; **Devin Enterprises**, 44500 Sierra Highway, Lancaster, Cal.; **Henry Disston Div. of H. K. Porter Co.**, Unruh and Milnor Sts., Philadelphia; **K-9 Products**, P. O. Box 12, Meadowbrook, Pa.; **Magna Power Tool Corp.**, Menlo Park, Cal.; **Market Forge Co.**, Everett, Mass.; **Master Bronze Powder Co.**, Calumet City, Ill.; **Millers Falls Co.**, Wells and Devon Sts., Greenfield, Mass.; **Remington Arms Co.**, Bridgeport, Conn.; **G. K. Stewart Co.**, 183 Mount Curve Blvd., St. Paul 5, Minn.; **Sunbeam Corp.**, 5600 W. Roosevelt Rd., Chicago 50; **Sure Simple Service**, P. O. Box 607, Elyria, Ohio; **Thor Power Tool Co.**, Prudential Plaza, Chicago 1; **Ungar Electric Tools, Inc.**, 4141 Redwood Ave., Los Angeles 66.

POPULAR SCIENCE REFERENCE LIBRARY NO. II

Home Owner's  
Money-Saving Guide to

# Choosing the Right Wrenches



# Where to find the facts

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## Foreword

WRENCHES are the steel hands and levers that let you raise the saddle on Junior's bike, stop the leak in the kitchen faucet, assemble your lawn furniture and bend that piece of wrought iron clamped in your vise. Wherever parts must be given a beefy turn—and often for fine adjustments—only a wrench will do.

Equally important, the wrong wrench won't do. This raises the question: How many wrenches do you need around the house? Nobody can say, although most experts agree on the ones you should own first. These are a standard auto monkey wrench and

a set of open-end, fixed wrenches. Beyond that, individual needs differ. But if you do a fair amount of home-maintenance work, have a power-tool-equipped shop, or like to tinker with your car, your stock of wrenches is bound to grow.

Whether it grows wisely depends upon your familiarity with a large assortment of tools. This booklet is designed to acquaint you with the wrenches that you, as a home owner, should know about. An understanding of their types and purposes is your most dependable guide for buying the ones that will serve you best.

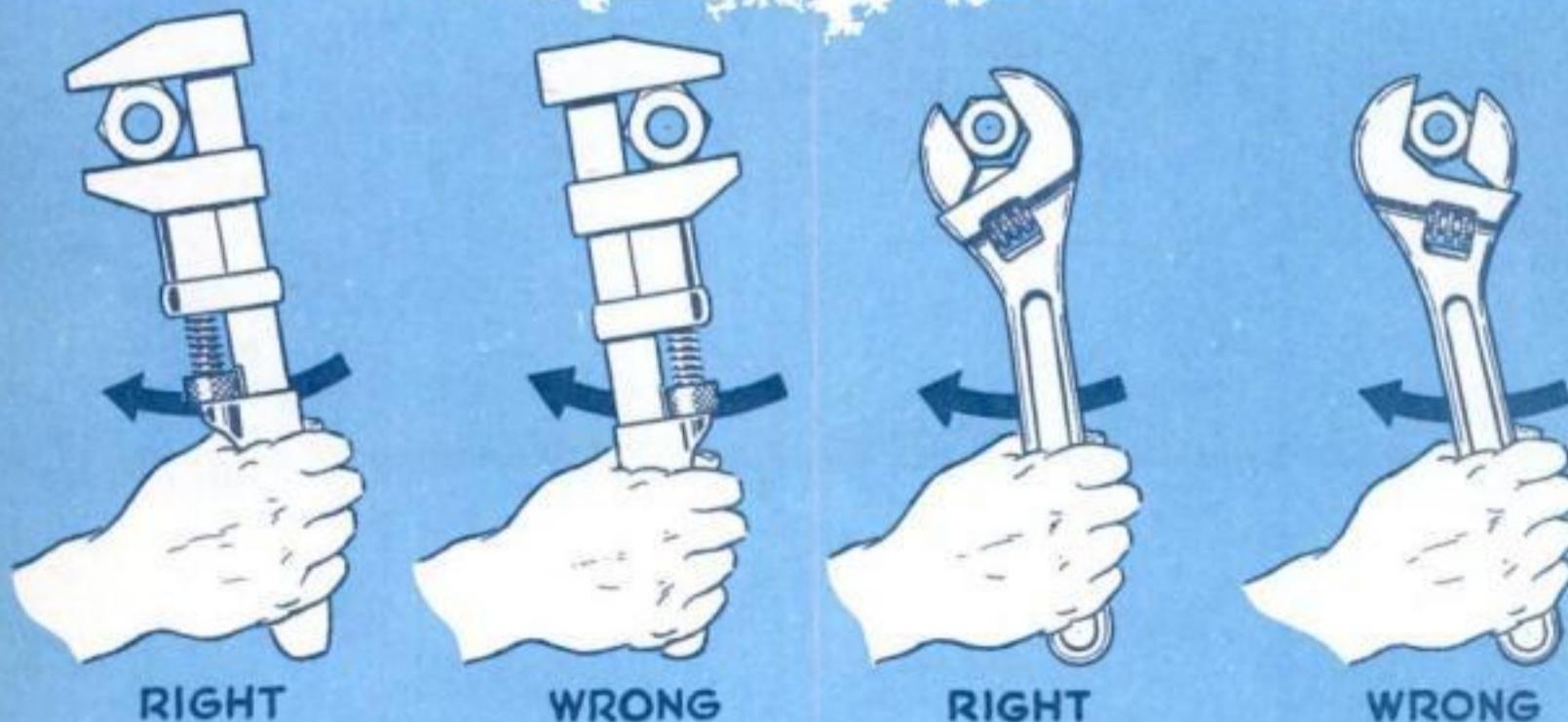
## Adjustable wrenches

**Monkey wrench.** Once the most common wrench, and the first "adjustable," this is a big-capacity tool. Heavy-duty models—the ones with broad jaws and hardwood handles—are of little use to the modern home owner. But the slimmer, 11" auto monkey wrench found in most car-tool kits has long been a do-it-yourselfer's favorite. It combines versatility with good strength, and its  $2\frac{3}{4}$ " maximum jaw opening makes it the economy-priced tool for backing off and snugging up large fittings, particularly those found in house plumbing.

There's only one hitch. Many tool manufacturers believe that the auto monkey wrench is on its way out. Because its jaws are placed at right angles to the handle, it can't reach into tight spots, or rotate hex nuts and bolt heads where the swing space is less than 60 degrees. Today's cars seldom offer such

liberal clearances, and even where they do, professional mechanics prefer less awkward tools.

Don't let this trouble you. There's still no shortage of auto monkey wrenches. But whether you already own one, or are about to make your first purchase, remember that this may some day become an irreplaceable tool. Take good care of it. Keep it grit-free (an occasional bath in cleaning solvent helps). Be sure there's always a small amount of light oil on its moving parts. Most important, use it right. Never hammer on the handle or slip a pipe over it to increase leverage. Before you turn anything, draw the jaws up tight. Finally, always pull on the side of the handle opposite the opening. That way, you'll save your knuckles, as well as the wrench and the fittings to which you apply it.





**Adjustable, open-end wrench.** This type is commonly called a Crescent wrench by mechanics who confuse the name of its first U.S. manufacturer with the product. The adjustable open-end is basically an auto monkey wrench with its head turned back to place the jaw opening at a 22½-degree angle to the handle. Its shape, which resembles that of the open-end, fixed wrench, makes it handy for reaching into close quarters, and the jaw angle lets it work where there's only half the swing space needed for a monkey wrench—you flip the head over for each new bite.

For still more flexibility, adjustable, open-end wrenches come in a variety of sizes, ranging from 4" to two feet. The jaw capacity of the big two-footer is 2 7/16"—or not quite that of the auto monkey wrench. While it's a far more husky tool, it costs at least 20 times as much (about \$22), and unless you do a lot of heavy work with off-size fittings you can live without one.

Don't overlook the convenience of the smaller adjustable wrenches, however. Even if you own a complete set of open-end, fixed-jaw wrenches, there will be times when only an adjustable can get a firm grip on some odd-sized part. For general use, a 10" wrench with a maximum opening of 1 1/8" is a good bet. Next choice, for small fittings, is a 6" model (3/4" opening).

When you buy an adjustable wrench,

**B4 CHOOSING THE RIGHT WRENCHES**

look for good workmanship in the moving parts. Jaw play in the sleeve should be very slight, and the rack teeth and knurl cleanly machined and smooth in action. Steer clear of designs in which the base of the opening meets the jaw faces at abrupt right angles; this makes for structural weakness. Base sections should either be milled to conform to a hex shape, or have curved or rounded corners.

If you're looking for refinements, you'll find a handy one in the locking mechanisms offered by several manufacturers. Once you adjust the knurl, the lock prevents it from being turned accidentally. Another useful feature is a calibrated jaw which lets you pre-adjust the opening for standard fittings.

For long life, keep the wrench clean and lubricated. Always remember that the best adjustable wrench is still not as strong as a fixed-jaw tool. Treat it with kindness. Adjust it properly and, whenever possible, place it on nuts or bolt heads in such a way that the pulling force is applied to the stationary side of the handle. This puts less of a load on the movable jaw.

**Lever wrench.** Also called a "locking plier wrench," the lever wrench resembles a sturdy pair of pliers, but uses compound hinging on one handle to increase leverage and provide a toggle locking action when it's closed. A thumbscrew in the end of the other

handle is used to control the jaw adjustment.

This is an extremely powerful gripper for its size. Properly adjusted, a 10" model weighing less than a pound and a half can exert a one-ton thrust at the jaws.

Lever wrenches come with either straight or curved jaws (the latter are used for gripping pipe or other round stock). In both cases, medium-fine cross teeth on the opposing surfaces insure a firm bite.

It goes without saying that such a wrench is not intended for use around nicely machined or chrome-plated fittings. But it's a good friend when you're dealing with already-jimmied bolts and nuts, or broken or rusted studs. As an auto-repair tool you may find a 7" lever wrench more convenient than a 10" model. On the other hand, even for small plumbing repairs—and the wrench can't handle big ones—you'll need the longer leverage of the 10-incher.

Bear in mind that the lever wrench is not intended to replace the specific tool for any one job. It's just what its manufacturers claim it to be—a husky little jack-of-all-gripping-trades—wrench, multiple-leverage pliers, portable vise and clamp. Sometimes a jack-of-all-trades is good to have around.

If you buy a lever wrench, be sure that it has heavy-gauge handle stampings, forged-steel jaws, and strong, snug rivet hinges. Oil these hinges occasionally, along with the thumbscrew thread. When you use the locking feature, adjust the thumbscrew carefully. The lower lever should close with an emphatic snap, but without your having to exert excessive pressure. A light squeeze releases the jaws when the job is done.



**Plier wrench.** It's stretching a point to call these pliers "wrenches." But their angled noses, and the nonslip features that hold their jaws nearly parallel at a number of settings, give them a family resemblance to the adjustable, open-end wrench.

Inexpensive plier wrenches use a groove with notched sides to provide from four to seven fulcrum points for a pivot bolt. The better ones have a clever cam arrangement that practically locks the lower jaw in position after you adjust it and squeeze firmly on the handles.

Like the lever wrench, the plier wrench has jaws with cross teeth. On some models they are angled to draw inward on round stock. Others have a combination of coarse and fine teeth—the latter placed at the outer ends of the jaws, where they're handy for gripping small objects.

Plier wrenches serve many of the same purposes as lever wrenches. While they'll give you nothing like the same grip, they're more convenient to work with in tight spots. A good 10" model costs from \$2 to \$3, depending upon the type of nonslip feature. This puts it in the price range of the lever wrench. Take your choice—beef or maneuverability.

## Fixed wrenches

**Open-end wrenches.** These workhorse wrenches more than make up for their fixed-jaw openings by offering greater strength and less bulk than adjustable open-enders. Also, with a few exceptions, they have a built-in safety feature—handle lengths that are proportional to their jaw openings. This means that you can apply only limited leverage to small fittings, reducing the chance of stripping threads or twisting shanks in two.

Open-enders come in a bewildering variety of designs and sizes, ranging from two-headed midgets weighing less than 1/6 of an ounce to single-headed construction models that are heavier than an axe. Jaw openings run from 5/32" through 7 5/8", may be angled 0, 15, 22 1/2, 80 or 90 degrees. A few open-enders have disproportionately short, chunky handles; on others they may be pencil slim and very long, or have a compound curve for greater swing where bolts or studs are close together.

For routine house repairs, you can forget the special designs. Your best bet is a set of conventional open-enders—tools with straight handles and a different-size head on either end, each angled 15 degrees.

The two most popular sets contain six and nine wrenches, and run from 3/8" through 1", and 1/4" through 1 1/8", respectively. Choose a nine-piece set if you put the accent on home maintenance or shop work. If your chief in-

terest is in car repairs, take a tip from professional garage mechanics and settle for a six-piece set, backed up by two other nests of open-enders. One is a four- or five-piece set of tappet, or check-nut, wrenches—tools whose long handles let you probe around a hot manifold without barbecuing your fingers. The other is a pocket-size collection of ignition wrenches—little fellows with openings from 7 3/2" through 7 1/16". Incidentally, these midgets are the right tools, too, for turning the machine-screw nuts found on all home electric appliances, TV sets and hi-fi rigs. Don't chew them up with pliers!

How can you judge the quality of open-end wrenches? First, be sure that they are forged tools (stampings on the handles will tell you). Check the jaws—they should be milled parallel. Whenever possible, invest in conveniently slim wrenches with pear-shaped heads. Reputable manufacturers make these tools of tough alloy steels, to compensate for their reduced bulk. Usually, too, they give them a chrome finish to prevent rusting.

Never use the wrong-size open-ender, or neglect to seat it squarely on the sides of a fitting. Pull on the handle, if you can. When this is impossible, hold your hand open and push with the base of your palm. Finally, develop a "feel" for just the right amount of torque, or twist, to snug up fittings without putting too much strain on threads or shanks.

**Box wrench.** As the name tells you, these wrenches have heads that completely "box," or encircle, bolt heads and nuts. They come in as many shapes and sizes as open-enders, and have several important advantages. Because an unbroken ring of steel is far stronger than two independent jaws, their heads can be made much smaller in relation to their openings. Then, by arranging 12 notches in a circle, instead of using a hex-shaped head, tool manufacturers have produced a very popular model called a 12-point wrench. This can turn a six-sided bolt head or nut where the swing space is only 30 degrees. Unlike an open-end wrench, it does this without your having to flop the head. Another nice box-wrench feature is its slip-proof grip—provided, of course, you are always careful to use the right size opening.

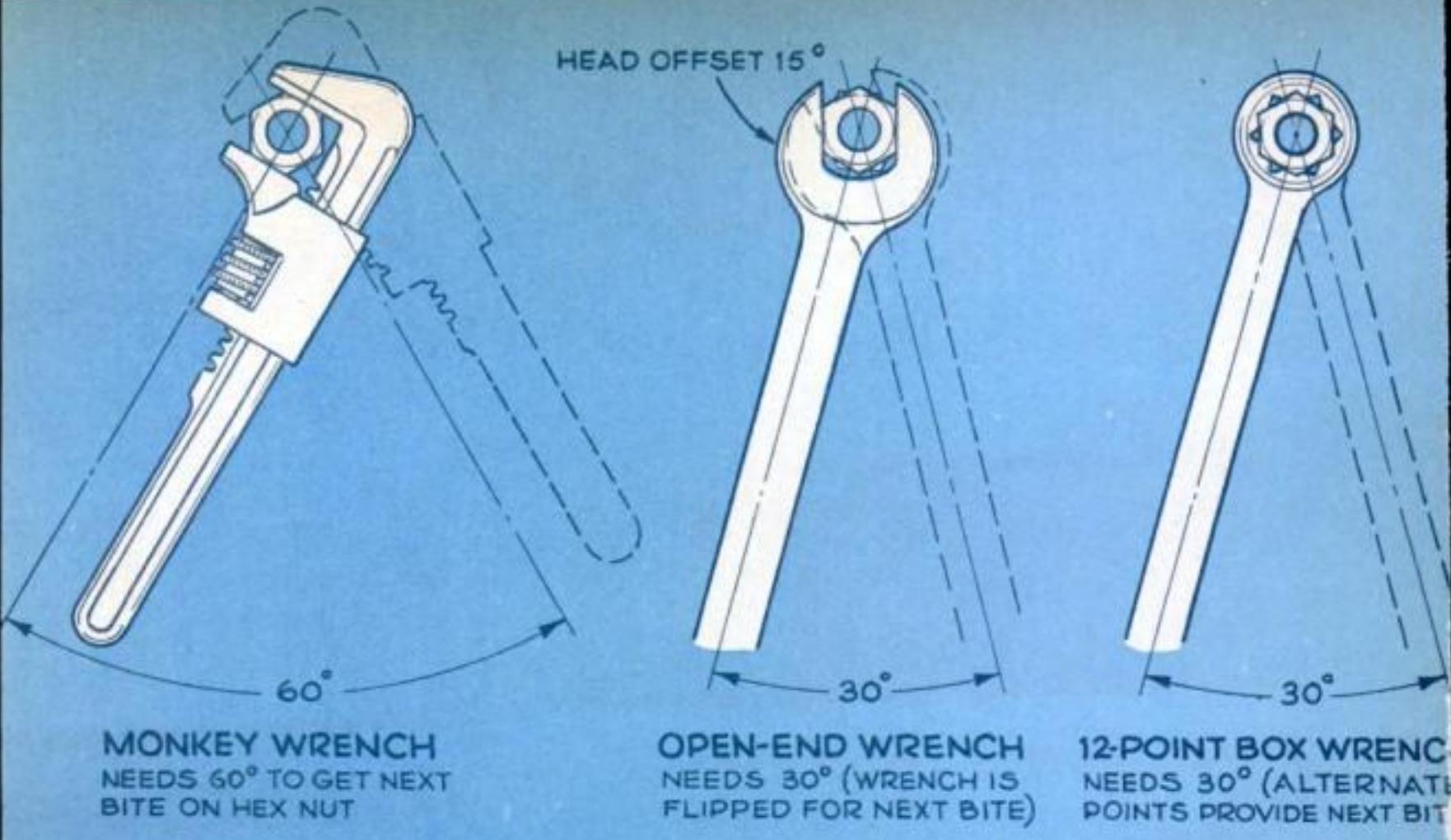
On the other hand, box wrenches can't collar fittings unless there is complete clearance at one end. This makes them useless as pipe-coupling tools. Also, except for a ratchet type, which gains convenience at the price of a bulkier head and less strength, box wrenches are slow to work with because the head is awkward to remove from—and replace on—fittings for limited-clearance turns. For this reason, pros always reach for an open-end where clearances and swing space aren't limited. They save the box wrench for the tight spots, and for giving stubborn bolts and nuts a break-loose turn, or a final snugging down.

If you buy a set of box wrenches for car repairs, a good starter is one with six tools offering 12 openings ( $\frac{3}{8}$ " through 1"). You'll have your choice of either straight or offset handles. Mechanics call the latter "knuckle savers" because they usually offer better clearance for your hand. Frequently, too,

you can get the handle past adjacent studs or bolt heads, where a straight shank would be trapped, or offer very little swing space.

There's another box wrench you should know about, on the off chance that you'll find yourself, some day, with a "frozen" fitting and very little leverage space. This is a single-headed 12-pointer, with broad pads or flats on its stubby handle. Called a striking-face box wrench, it's the only gripper you should ever hammer on. Designed to exert high impact force, it can take hard slugging. But if you ever use one, remember that the part you're trying to free may resent the same kind of treatment and break in two. Coax it with a series of sharp, not too heavy blows.

You may also want to consider a tool that resembles a box wrench, but has a section cut away at the top of each of its two heads. This is a flare-nut wrench, designed for use on automobile fuel lines, and handy, too, for repairs on your power lawn mower, oil burner or air conditioner. The open sections let you pass the wrench heads over the relatively small tubing used with flare couplings. At the same time, the more than half-round enclosures give you a firm grip on hex-shaped brass fittings, which are easily damaged when an open-end lets go. A set of three flare-nut wrenches ( $\frac{3}{8}$ " through  $\frac{3}{4}$ ") runs a bit more than \$3.

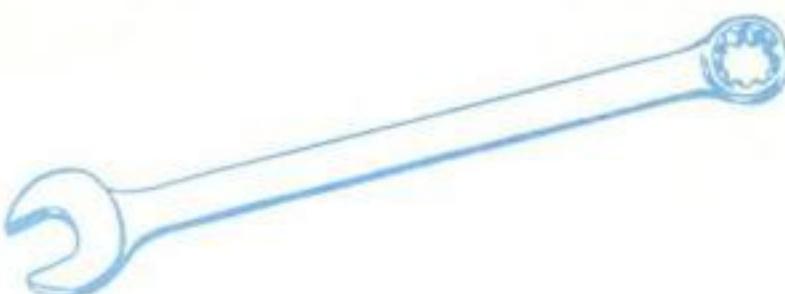


**Combination wrench.** This is a hybrid, with a box head at one end, and an open end of the same capacity at the other. Pros like it because, with a flip of the handle, they can work on a fitting with either the break-loose and snug-down strength of a box wrench, or the greater speed of an open-end. Unfortunately, this is a convenience you must pay for. A single large set of combinations doesn't give you the working range of two smaller sets of open-end and box wrenches. Often you need two openings of the same size, to part or tighten fittings. Most combination wrenches offer them where they're useless—at opposite ends of the same handle. For this reason, a few

combination sets are made with staggered-size openings at the ends.

Combinations differ in other ways, too. Most have their box-wrench ends angled at 15 degrees for convenient handle clearance. On some, the open-end heads have a ratcheting device—a feature that makes sense because speed, and not high torque, is what you want at this end of the tool. You'll also find wrenches that combine a flare-nut head with an open-end of the same capacity. Again, it's a convenience you usually pay for by buying a larger set.

Finally, there are combination midget, or ignition, wrenches. Some mechanics prefer them to two-headed open-enders, because their 12-point closed heads are handier to work with in tight quarters. There are times, however, when only an open-end, with one head angled at 15 and the other at 60, 75 or 80 degrees will do. Sets of either type cost about the same.



**Socket set.** Borrowing from the bulky wrench you use on wheel studs when you have a flat tire, tool designers have produced a wonderful assortment of shiny little automobile fixers called a "socket set." Combining detachable heads, or sockets, with a number of ingenious handles, it is a favorite of all car mechanics, including the weekend wizards.

You can spend just a few dollars or a small fortune on one of these sets. But the sockets are your first concern. All of them are drum-shaped, with either a hex, eight-point or 12-point opening at one end, to grasp fittings. At the other end is a standard-sized square hole for handle coupling. The fitting openings may be no deeper than they are wide, or they may be greatly extended, to let you get a bite on hard-to-reach parts like recessed spark plugs. Capacities range from  $3/16"$  for the smallest midget, to  $3\frac{1}{8}"$ . At the other end, handle holes measure  $\frac{1}{4}"$ ,  $\frac{3}{8}"$ ,  $\frac{7}{16}"$ ,  $\frac{1}{2}"$ ,  $\frac{3}{4}"$ , or  $1"$  across the flats, depending on the set. This is called the "drive" size.

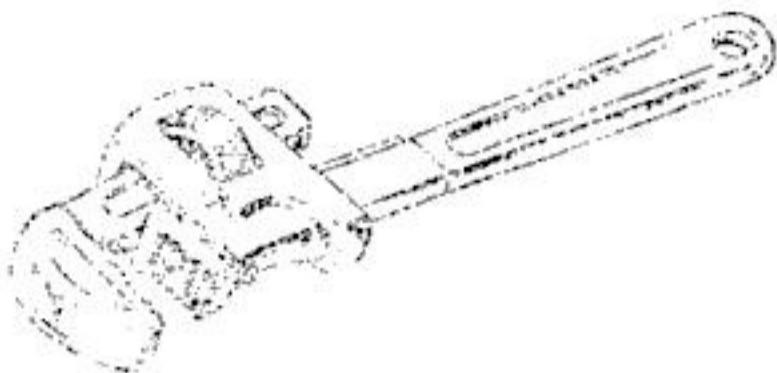
Look for slim-walled sockets made of high-alloy, forged steel. Examine the fitting openings. The gripping areas should extend clear to the bot-

tom, and the base should be flat, except for a slight curvature where it flows into the side walls. A bell-shaped bottom is the mark of a cheaply made and inferior socket.

In midget sets, the smallest openings are hex-shaped, with a pair of eight-pointers generally thrown in to grip  $\frac{1}{4}"$  and  $5/16"$  square nuts. For sockets between  $5/16"$  and  $1\frac{1}{2}"$  (the largest midget size), some manufacturers change over to 12-pointers. A set of these little wrenches—especially one with several handles including a ratchet type—is handy but not indispensable for ignition, radio or TV work.

The socket set you should own, if you probe deep under a car hood, has a drive size of  $1\frac{1}{2}"$ . A very useful nest that costs a little more than \$8 will give you fourteen 12-point sockets (with openings ranging from  $7/16"$  through  $1\frac{1}{4}"$ ) and a solid L-shaped handle. Chances are, you'll soon find excuses for buying a number of auxiliary handles and attachments like the ones shown at the bottom of this page. These include a flex "T" handle, ratchet wrench, speeder wrench, extension bars and universal joint. The painless way to invest in them is one by one, as they're needed.

# Pipe wrenches



**Stillson pattern wrench.** Scramble the parts of a monkey wrench and put teeth in its jaws. The result is a Stillson wrench, whose lower—not upper—jaw is integral with the handle. Hinged to it is a knurl-holding cross member called a housing, through which the threaded shank of the upper jaw passes. When you pull on the side of the handle opposite the jaw opening, the hinge makes the jaws close on the part to be turned, and the grip increases automatically, the harder you tug.

This plus their teeth give Stillson wrenches the bulldog bite that's needed to turn stubborn pipes, round fittings and rods; or to hold them like a vise while other parts are threaded on or off.

Stillsons come in a number of sizes, with maximum jaw openings ranging from  $\frac{1}{2}$ " through 3". The smaller ones are generally not as useful as a lever wrench, but an 18" model with 2" capacity may save you many times its \$3 cost.

Give a Stillson the same care you would a monkey wrench, adding a light filing job to resharpen the teeth when necessary. Except as a last resort, never apply these teeth to a fine, bright fitting. When you must use a Stillson on such parts, wrap a liberal cushion of cloth around the fitting first. Then pull as gently and as steadily as you can.

B10 CHOOSING THE RIGHT WRENCHES

**Heavy-duty pipe wrench.** The chief difference between this wrench and the Stillson is in the handle construction. Instead of having a separate hinged housing for the upper jaw, this part is forged integrally with the handle and lower jaw. The result is a stronger but much more expensive tool. Write it off, for ordinary house repairs.

**Chain pipe wrench.** A remarkably simple tool that serves the same purpose as the Stillson, the chain pipe wrench offers greater speed and less bulk. Its two parts are a tough, forged handle with a few cross teeth arranged in an arc at its working end, and what looks like a length of heavy sprocket chain with extended link pins. One end of the chain is fastened to the handle just behind and below the teeth.

To use a chain wrench, you place the teeth on the object to be turned, wrap the chain around the part, and slip the link-pin ends that give you the snuggest fit over a couple of hooks at the top of the tool head. Pulling on the handle sets up a combined cam and lever action that forces the teeth against the part and draws the encircling chain tight.

The biggest advantage of this tool is its ratcheting action. Once positioned, the chain can be left in place—you simply back up the handle for successive bites. A chain wrench with a capacity ranging from  $\frac{1}{2}$ " to 4" costs about \$2 more than an 18" Stillson.



**Strap wrench.** A gloved-hand variation of the chain wrench, the strap wrench uses either a leather or web strap to encircle and turn parts that are nicely finished without damaging their surfaces. Unlike the chain wrench the strap type has a toothless concave—not convex—jaw at the end of the handle. To use this tool, you wrap the strap completely around the part, and cinch it back through a stirrup at the bottom of the jaw. When you pull on the handle, the strap section between the jaw and the fitting acts as both a cushion and a friction area, giving you the grip that's needed to draw the rest of the loop taut.

A strap wrench costs a bit less than a chain wrench, but may be harder to find. If your favorite hardware store doesn't stock them, you'll have to look up a plumbing-supply house.



**Basin wrench.** This plumbing tool is designed to get at nuts and cap heads where there's no clearance for direct radial swing. Its main part is a long bar with a T handle at one end and a toothed head at the other. A crescent-shaped jaw, also fitted with teeth, is attached to the head with a swiveling hinge. To grip a fitting, you wrap the curved jaw around it with one hand and turn the handle with the other. When the teeth take hold you increase leverage—and off comes the part. Flipping the jaw over lets it work in the opposite direction.

A basin wrench with a maximum capacity of  $1\frac{1}{4}$ " costs about \$2.

## Special wrenches

**Setscrew wrench.** Wherever fairly high torque must be applied, setscrews have small wrench holes, rather than screw slots, in their heads. These holes may be square, hexagonal or fluted. They also vary in size, depending upon the diameter of the screw. In the case of the square and fluted types occasionally found in shop tools, power lawn mowers and the like, the manufacturer usually provides you with the right wrenches to handle them. Hex-hole, or "Allen" type setscrews are so common, however, that everyone assumes you have your own wrenches. You should. The most complete set you can buy, with a combination of short and long turning arms, and sizes ranging from  $1/16$ " through  $5/16$ ", should cost no more than \$1.50, including a plastic carrying case.



**Spanner.** The sun never sets on mechanics who call practically all wrenches "spanners." But here in the States a spanner is a special kind of tool. It's one that gets a turning grip on a fitting by slipping one or more pins or lugs into holes near or on the edge of the part. Multiply the variety of spanner types by countless special sizes, and it's useless to try to anticipate which ones you may need. The machine or appliance that requires a spanner generally offers it in a servicing kit. Don't lose the replacement-parts list, however—or you may not know what to ask for, if you have to send in for another one.

P. S. EXTRA:  
YOUR TEAR-OUT  
BOOKLET NO. 11



To remove this booklet, place your left hand on the facing magazine page, grasp the booklet with your right, and pull it gently away.

After reading, file for future reference. You'll find it valuable on many home jobs.

*August 1958*  
**POPULAR SCIENCE**

# 3

## fine brands of guaranteed wrenches to choose from

### P & C **CLIK-STOP** WRENCH

holds exact jaw openings  
automatically...

#### won't work loose

P & C's amazing new Clik-Stop wrench works like an ordinary adjustable. Just turn the patented Golden Knurl, jaw locks automatically at any opening. Pick it up, drop it, kick it...jaw won't work loose or "creep." Chrome plated, backed by famous P & C guarantee. Ask your dealer today about P & C Clik-Stop.

Shop from the  
colorful P & C tool  
merchandisers in  
more than 12,000  
stores coast to  
coast. Send 10c  
for catalog.



**P & C** **TOOL COMPANY**

Box 5926, Portland 22, Oregon  
Chicago Warehouse, Box 89, Schiller Park, Ill.

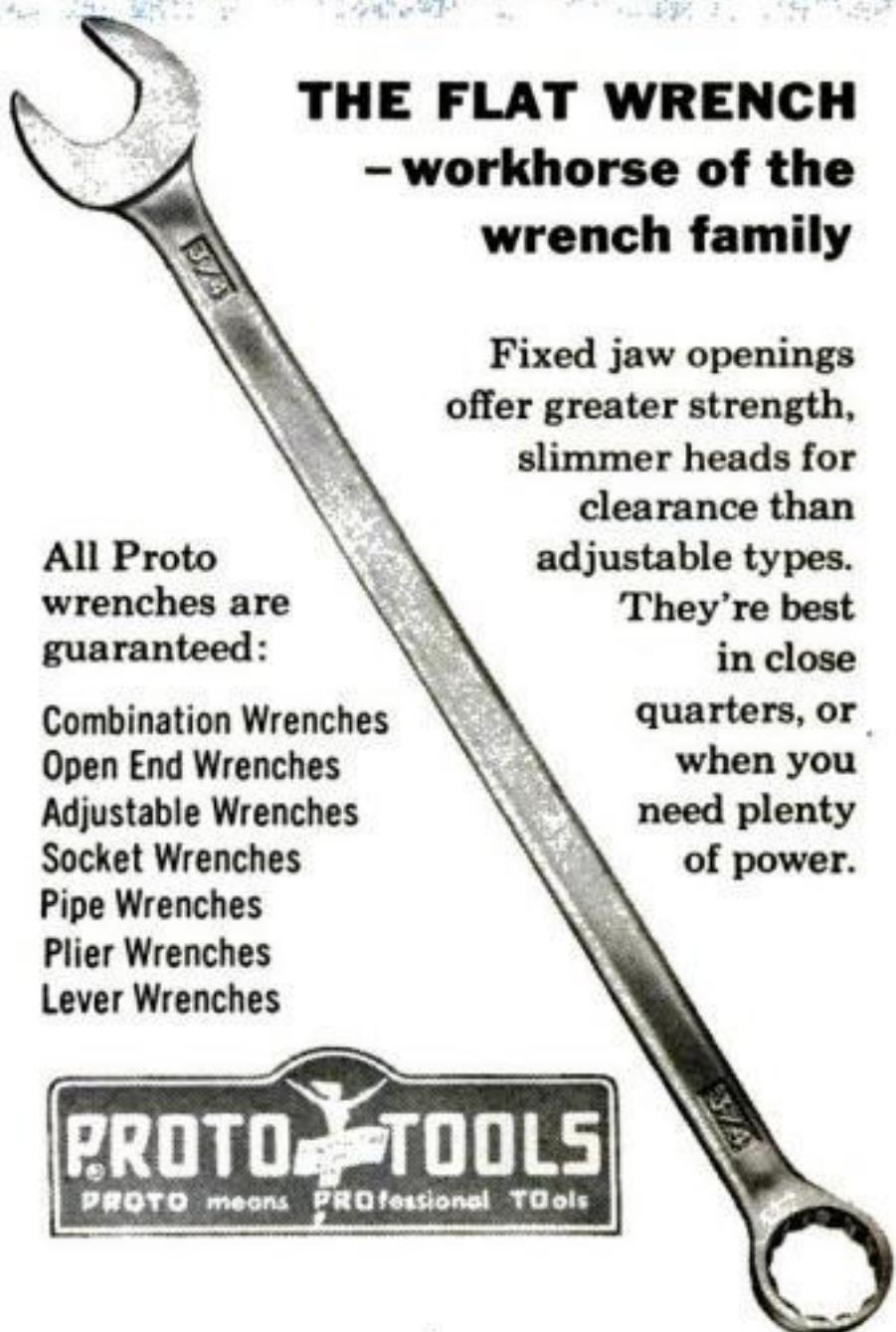
Subsidiary  
Pendleton  
Tool  
Industries

**challenger**  
FINE TOOLS

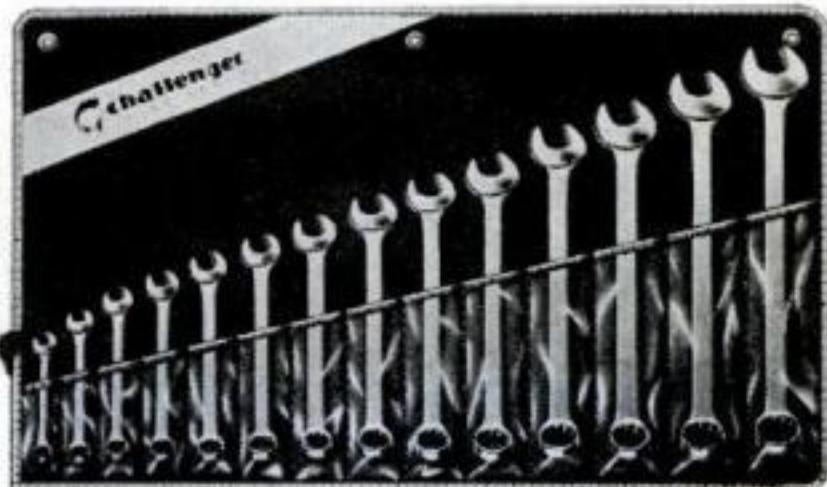
**14 pc. COMBINATION WRENCH SET**  
**No. 6154.** Complete set of DOUBLE  
UTILITY Combination Wrenches. OPEN  
ENDS for regular nut turning and BOX  
ENDS for recessed fittings. Handles all hex  
and square nuts from  $\frac{3}{8}$ "- $1\frac{1}{4}$ ". Tough alloy,  
chrome plated, in compact "Roll-up" Kit.  
Penens Tool Corp., Schiller Park, Illinois

### THE FLAT WRENCH — workhorse of the wrench family

Fixed jaw openings  
offer greater strength,  
slimmer heads for  
clearance than  
adjustable types.  
They're best  
in close  
quarters, or  
when you  
need plenty  
of power.



**PROTO**   
**TOOLS**  
PROTO means PROfessional TOols



# New 12" Lathe Has Quick-Action Tailstock

**A**BIGGER swing and a wide feed and thread range highlight a new line of 12" lathes offered by the Atlas Press Company, Kalamazoo, Mich. These new lathes have the same flat-bed design used in the maker's popular 6" and 10" series. The bed casting, which has box ribs every 4", is ground to within .001" accuracy.

Work up to 12 $\frac{1}{4}$ " in diameter can be swung over the bed, or up to 8" over the cross slide. Two bed lengths provide 24" and 36" between-centers capacities. A heavier carriage has six full-length bearing surfaces, totaling almost 34 square inches, on the bed.

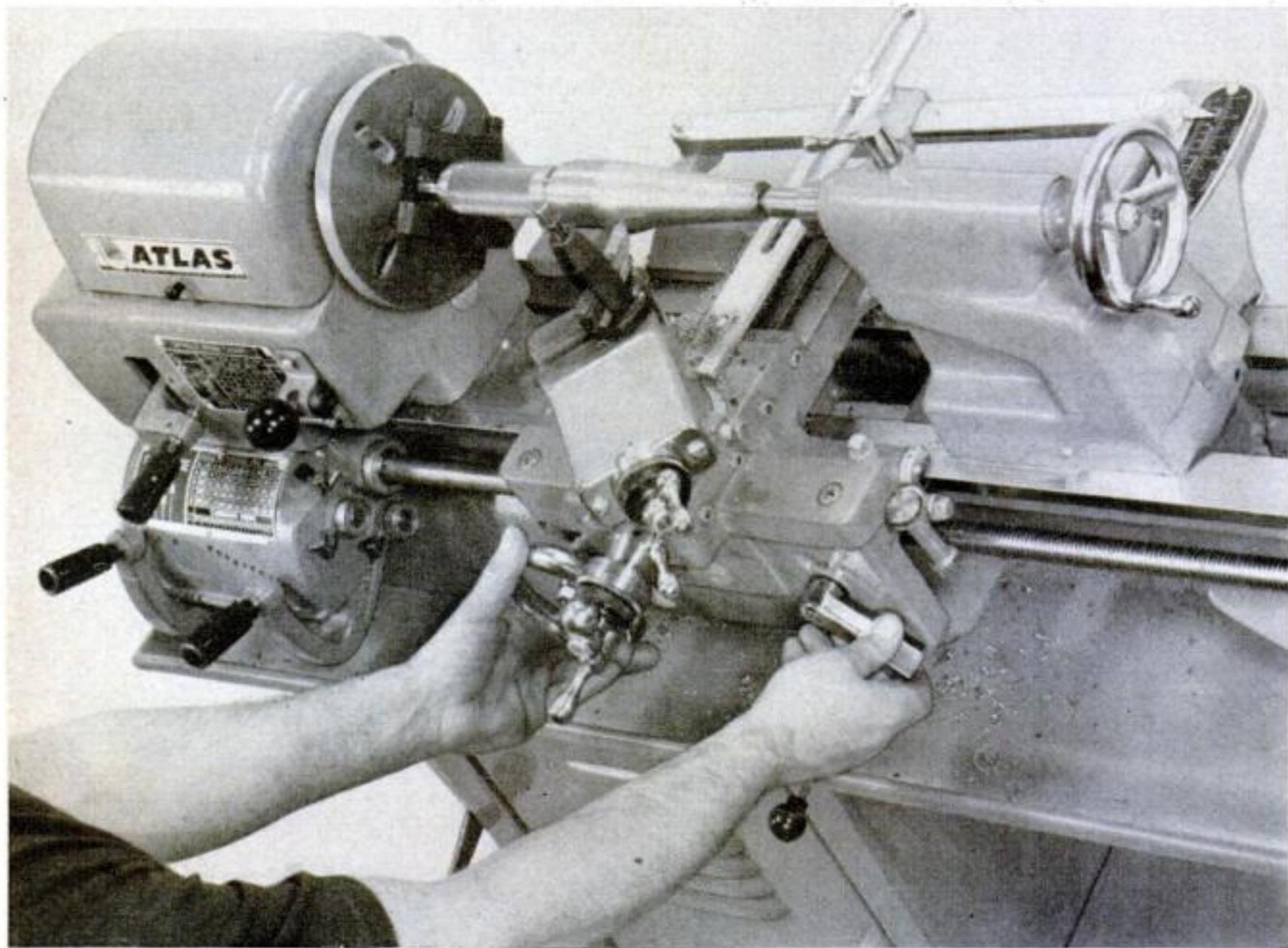
Tapered roller bearings on the spindle permit a wide range of speeds from 28 to

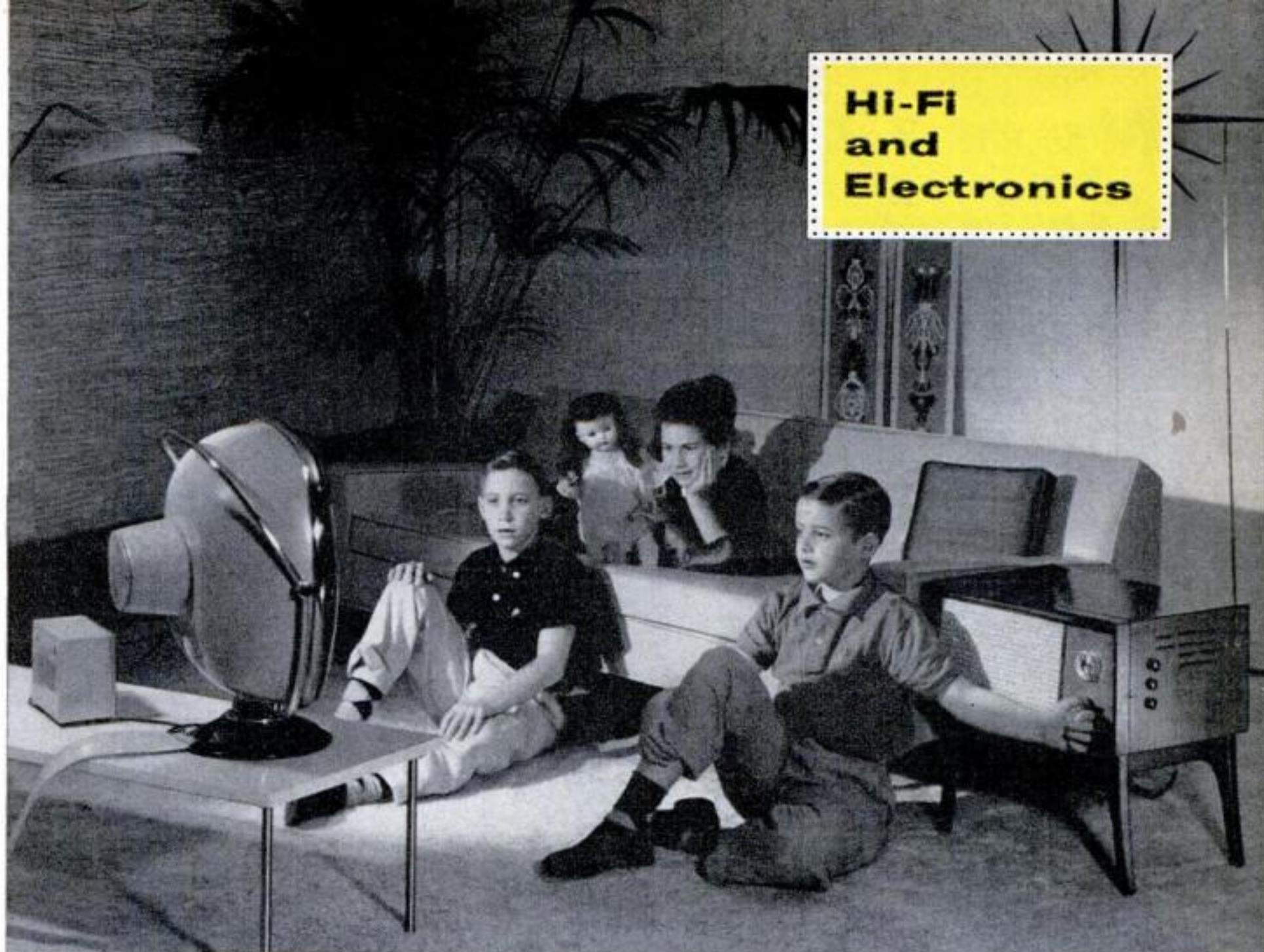
2,072 r.p.m. (eight direct, eight back-gear) that make the lathe suitable both for heavy roughing cuts and high-speed turning of metal, plastic and wood, as well as metal spinning. Standard equipment includes reversible automatic power cross and longitudinal feed, threading dial, and built-in motor switch.

Starting at \$325 for the 24"-capacity bench lathe with standard change gears, the line includes quick-change and pedestal-base models, the latter with underneath drive. Change gears afford 98 threads or feeds and will cut Metric as well as National Fine, National Coarse, Acme, Square and Whitworth threads. The quick-change gearbox provides 54 threads or feeds through cut-steel gears.

**NO KNUCKLE BUSTING** when you're working with carriage close to the tailstock of Atlas' new

12" lathe. Fast-acting bedlock is placed conveniently out of the way behind it.





## 2-Piece TV Has Portable Picture Tube

**Designers pluck the tube out of the cabinet and stand it by itself in Philco's '58 line**

**By Hubert Luckett**

A MANUFACTURER of television sets has about as much chance of keeping a radical development secret as he would an elopement planned on a rural party line. The picture tube pretty much dictates the basic dimensions of any styling change. And all picture-tube envelopes come from the same supplier.

This was the problem facing the planners at Philco two years ago. They had been poring over statistics that pointed to a distinctly unhappy future for TV manufacturers.

The discouraging prospects appeared to be these:

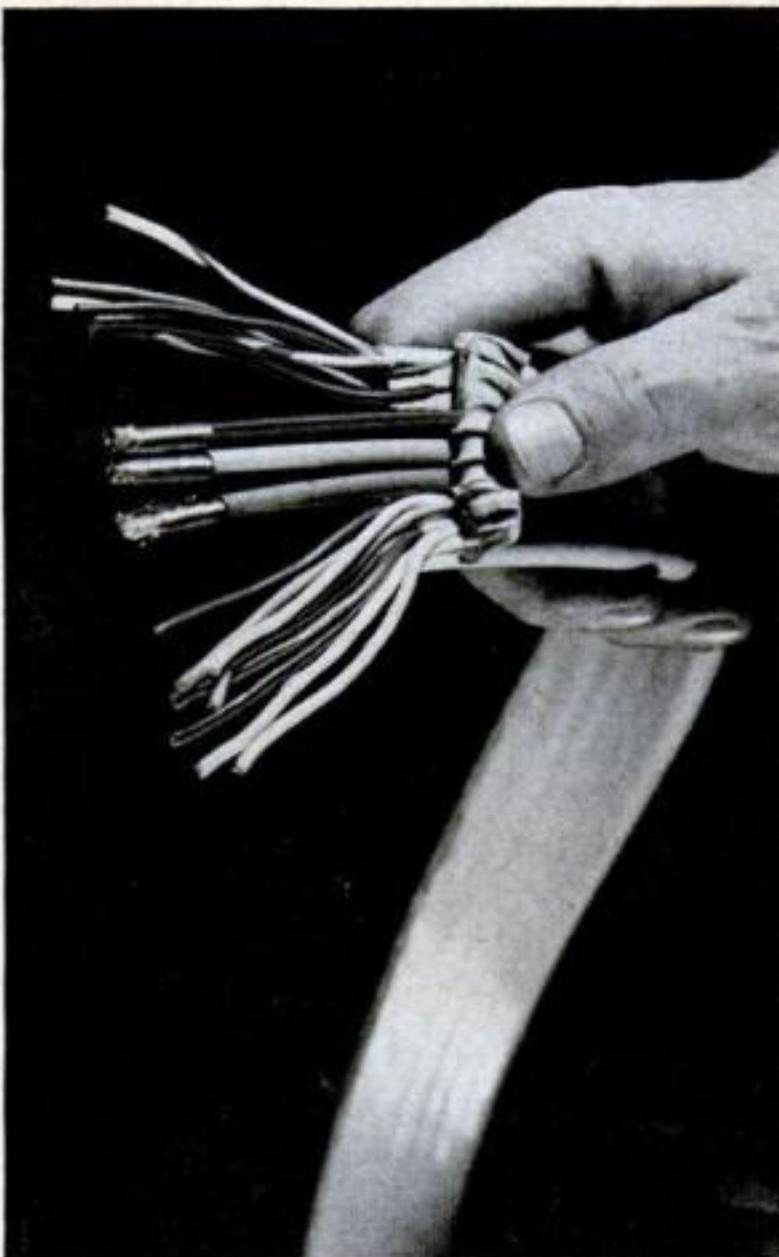
- Just about everyone not still reading

by a kerosene lamp would own a TV set by 1958.

• People were hanging on to their old sets. Customers who would sooner let their wives wear last year's fashions than drive a five-year-old car were still watching TV sets that had been bought six or seven years before.

Taking a disenchanted look at the sets introduced annually since the 21-inch tube became standard, Philco's market analysts made a surprising discovery: It was almost impossible to distinguish the latest models from those of three or four years back. Except for the larger tube face, the basic idea of a TV set had never changed—it was simply a box with a window in it.

The industry had failed to develop a re-



**PICTURE PIPELINE:** A fistful of conductors are molded in a flat ribbon of tough plastic to supply operating voltages and signal to the remote picture tube. Cable also carries sound signal so that an accessory speaker can be plugged into the base of the remote tube.



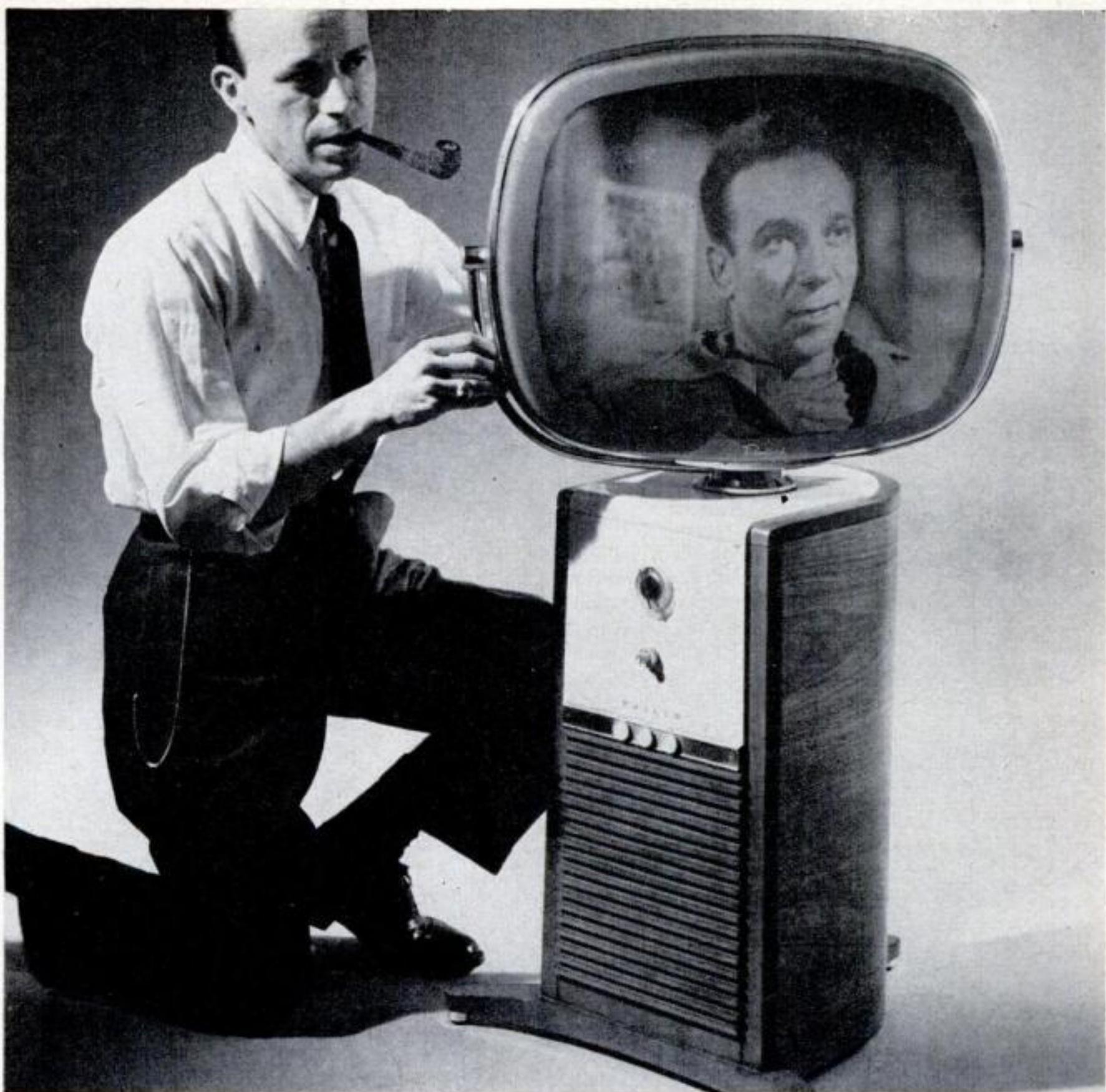
**CHAIRSIDE TABLE** holds chassis with controls and loudspeaker. Picture tube may be placed anywhere in the room within 25 feet. Connecting cable can go under the rug or around the baseboard.

placement market simply because it offered no compelling reason for the customers to give up their old sets.

Starting with this fresh insight (fresh to the manufacturers, that is; the customers obviously knew it all along), Philco launched a two-year program. They went along with the rest of the industry in '57, packaging the then new 110-degree picture tube [PS, Nov. '57] in the conventional box-with-a-window.

Meanwhile their designers worked overtime, racing the calendar to have their big dream ready for '58.

It soon began to appear that they were stymied. If they were to keep their secret—and a competitive advantage—they had to get along with the standard picture-tube envelope. But they needed a more compact tube to fit their plans for a showy new appearance in TV receivers. They licked the problem—not by a technical discovery—but by snipping away at the space required by the electron gun in the tube neck. They gained a full two inches. The needed alterations in the tube envelope could be done in the privacy of their own plant. The result, according to Philco engineers, is

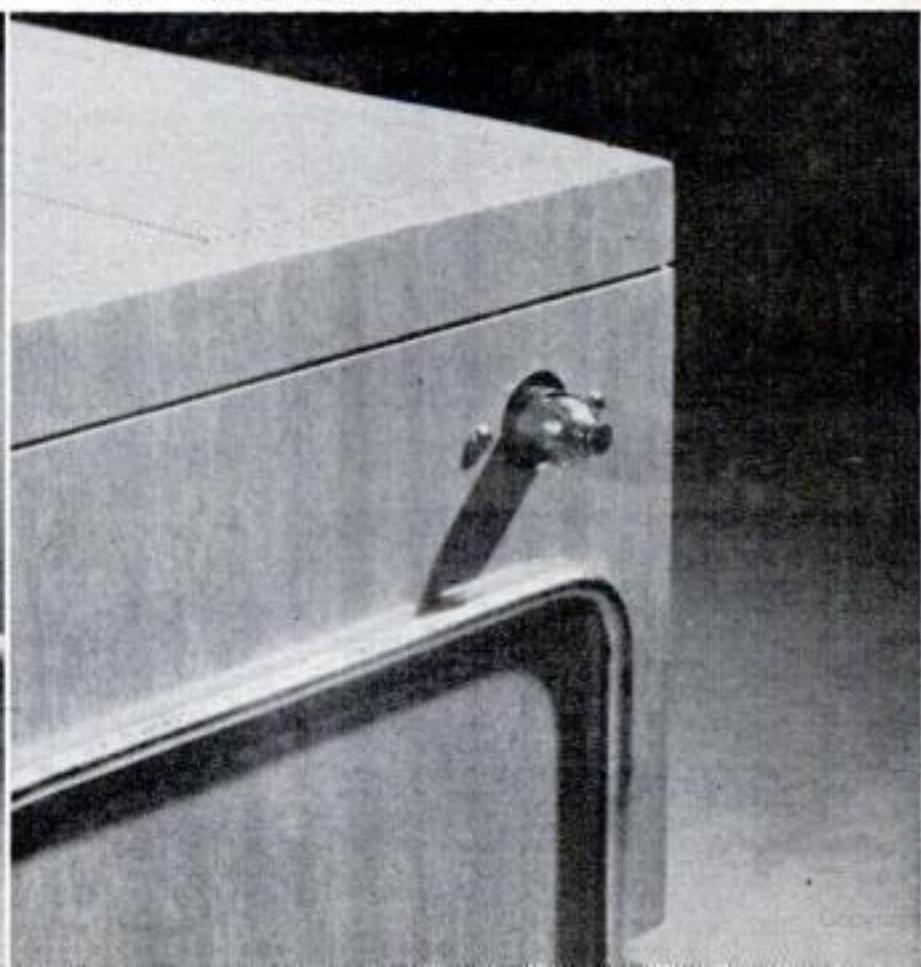
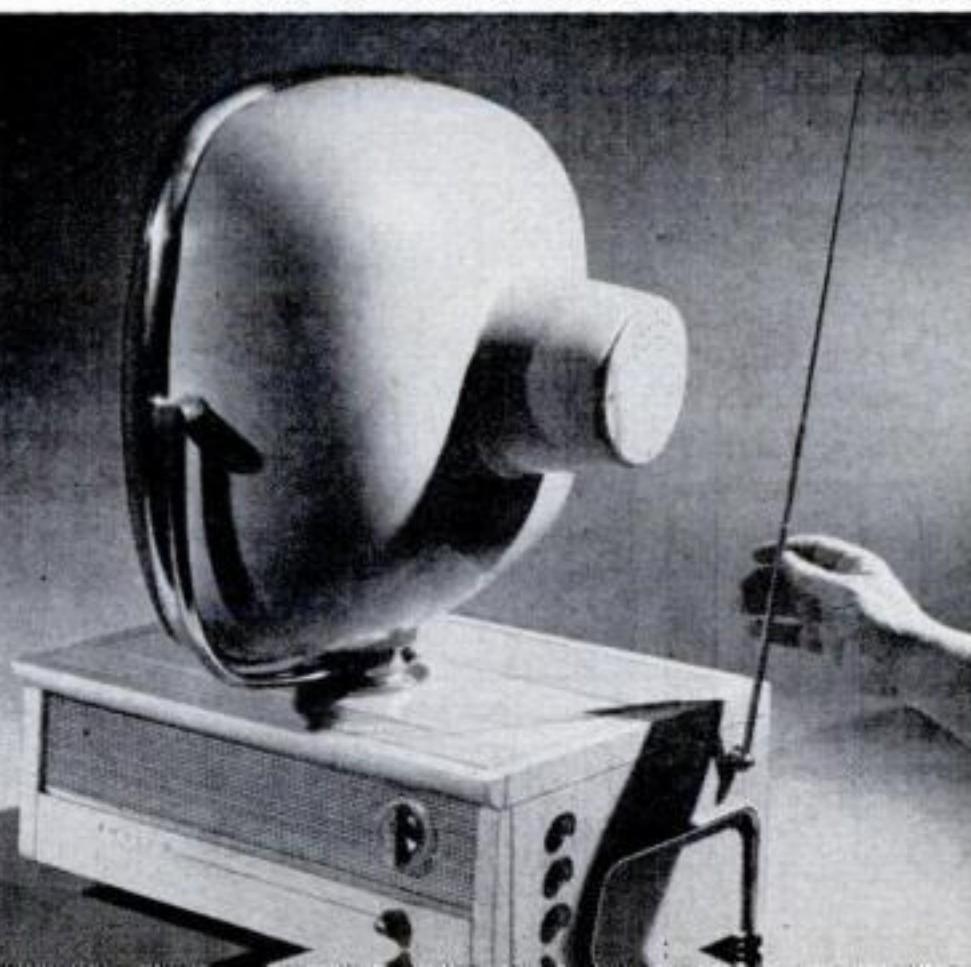


**PICTURE TUBE IS ENCLOSED** completely in a plastic capsule, swivel-mounted atop a pedestal base

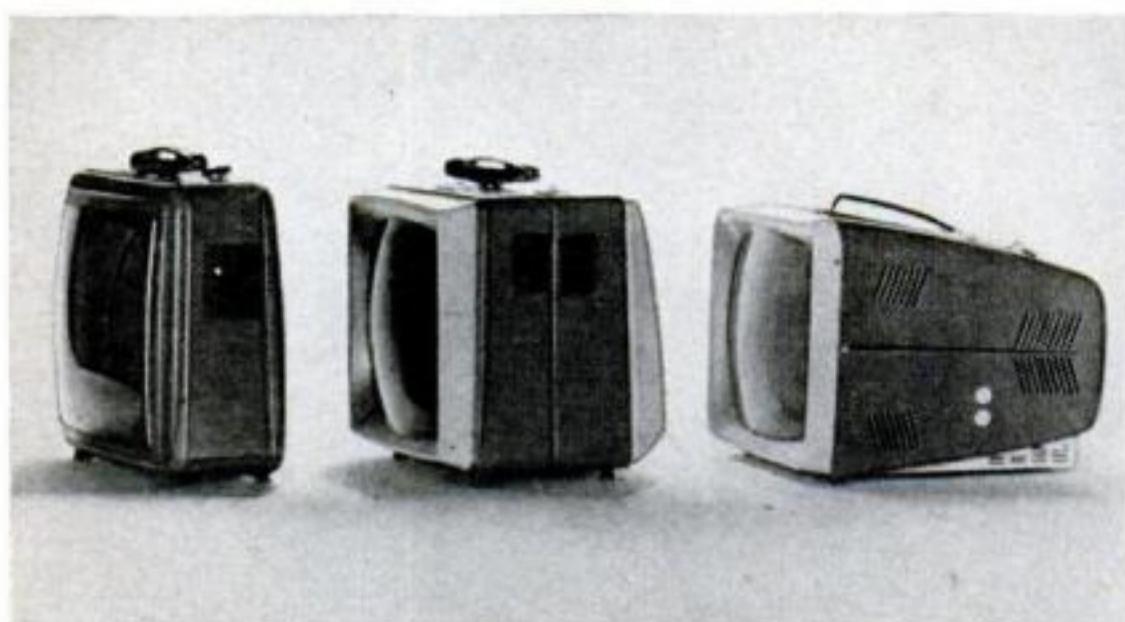
**COMPACT TABLE MODEL** with swivel tube gives a full 21-inch picture, yet the package is small enough to be carried easily about the home.

containing the chassis. An eight-inch speaker in the base gives you out-front sound.

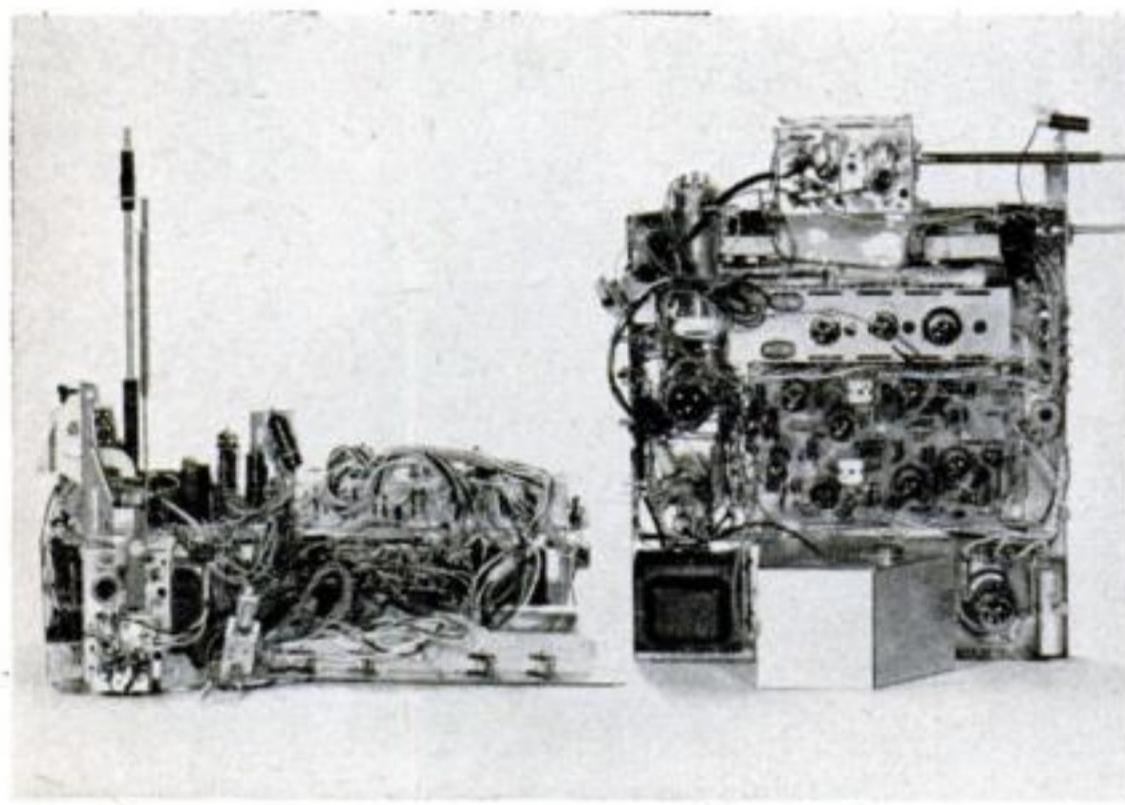
**TELESCOPING ANTENNA** replaces the former unsightly "rabbit ears." It collapses and disappears inside the cabinet when not in use.



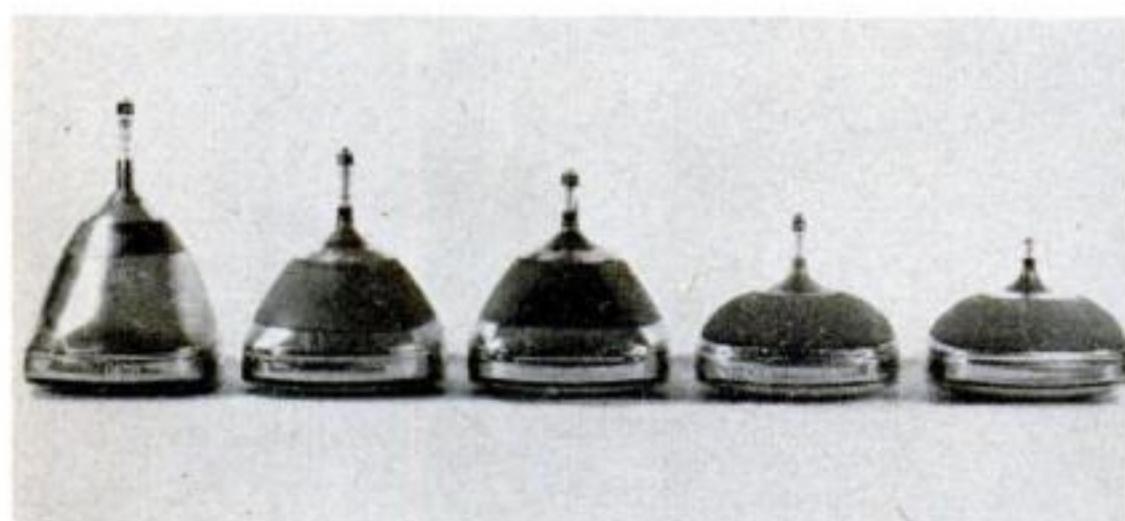
## **Not a picture-on-the-wall yet, but these sets go far in that direction**



**HERE'S WHAT HAS HAPPENED** to portable television sets in only three years. On the left is the "Slender Seventeen," a 17-inch set made possible by the new, shorter picture tube. It has a built-in, rotating antenna that serves as the handle.



**CHASSIS HAD TO BE SQUEEZED**, too, to fit into the new windowless cabinet. On the left is all that remains after engineers had packed all the "works" contained in the standard chassis (right) into suitable form for the new sets.



**SHORT HISTORY OF THE SHRINKING PICTURE TUBE:** Line-up of 21-inch picture tubes used in the past eight years shows how the length has steadily decreased. Latest 110-degree Philco tube is a full two inches shorter than last year's.

the shortest 21-inch picture tube ever produced for the consumer market.

Here was a tube compact enough to be capsule in plastic and given an independent role in the design of a TV set.

Three versions of separate screen television are the result: a table model and a pedestal model with the picture tube swivel-mounted on top, and a two-piece job that lets you put the picture anywhere you like while the chassis and controls stay within easy reach of your armchair.

The new sets will be easier to service than the old-fashioned kind, Philco claims. The chassis slides out of the back of the cabinet like a file drawer to make tube replacement or other servicing a breeze.

Laboratory tests indicate that the picture-tube mount provides a greater margin of safety against implosion (bursting inward—opposite of explosion) than the usual mount inside the cabinet. Stray radiation that might interfere with nearby receivers is claimed to be less than the FCC minimum requirements.

There was an unexpected bonus along with the new picture-tube package—the face of the tube doesn't get dirty. Because of high voltage, a tube face usually collects dirt the way glass on a penny-candy counter collects fingerprints. It needs frequent cleaning to give a bright picture, which usually means removing the chassis from the cabinet or at best removing the covering safety glass. But with the capsule tube, the dirt collects on the outside of the plastic cover where it can be easily wiped off. **END**

**Test equipment is the fix-it man's best friend. But it may be a real nuisance if it forces you to solve—**

# TV Troubles on Vacation

**By Art Margolis**

**M**Y KID cousin started the rumor that I check voltages with my fingertips. That's a gag he once pulled—but that's another story. There are times, however, when I wish I had some magical touch like that. I could use it to back up my testing equipment when it tries to give me a bum steer.

Testing devices have their quirks and limitations. Unless you're aware of these, and know how to use the devices you may find yourself with false symptoms, a wrong diagnosis, no cure.

As a TV repairman, I know that they can be my best friend. But even the best

of friends needs understanding. Anyway, that's been my experience, particularly so last summer when my vacation turned out to be a busman's holiday. We had de-



## TALES OF A TV REPAIRMAN

cided to splurge on a week at a fancy mountain-resort hotel. It was a rainy Sunday morning. The two kids and I were having a lazy day up in our rooms, dressed in look-alike pajamas my wife had bought for the occasion. She was downstairs playing bridge.

The kids were feeling the confinement and when a game of tumbling on the floor threatened to get out of hand, I got up from my crossword puzzle and turned on the TV set. After a few minutes of good sound and picture, the screen filled with black-and-white horizontal striping, accompanied by a loud buzz.

This was my vacation, so I didn't even examine the set. I called room service and dropped the problem in their lap. A few minutes later, as the kids were having fun matching the striping of their pajama tops with the screen pattern, there was a knock on the door. "Come in," I called, and a young bellhop entered, carrying a tube caddy and a tube tester.

"You called for TV service, sir?" He was dressed in a red, gold-buttoned uniform with a pillbox hat to match. He went over to the set and began fiddling with the controls.

"He's just making the stripes wiggle," giggled one of my youngsters. Kibitzers are my pet peeve when I'm working on a TV set, so I divided the Sunday comics between the children, told them to be quiet and settled back with my crossword puzzle.

By now the bellhop had pulled the set away from the wall. He looked at the insides as if he expected to see the trouble. Then he began his trouble-shooting, taking the tubes out one by one and testing them in the tube checker. When he had changed about six unnecessary tubes, I couldn't take it any longer. I got up and introduced myself.

"Gee, mister," he said, "I'm not really a TV man—I'm just a college student working for the summer. Our regular is in the hospital and since I hang around his shop a lot they hooked me for the job."

"Mind if I help?"

"That'd be swell, Mr. Margolis." He added, "They call me Red—because of my hair."

"Okay, Red." I got down next to him,

turned the set on, and explained that he should always start by analyzing the symptoms. The TV set performed for a few minutes. Then, as before, the sound became a 60-cycle hum. One black and one white stripe appeared on the screen—a *picture* of a 60-cycle hum.

Since the bellhop seemed interested, I gave him a rundown on my diagnosis. The 60-cycle current originates in the power mains. Inside the TV, it is passed through the tube filaments as heater power. So that the heater power will not mix with the sound or picture signal, the filaments are isolated. If the filament current somehow leaks across into the rest of the tube, you get this hum.

Here the hum indicated such a leakage. But which tube, since the hum was present in both audio and video? In this particular set the audio and video pass together through the two tuner tubes and the three IF tubes. A filament-to-cathode leak in one of these was probably causing our trouble.

I checked the tubes, one by one, by direct substitution in the set, not with the tube checker. As I replaced the second IF, the hum disappeared. Just for the heck of it, I put the leaking tube in the tester. It read GOOD. Looking puzzled, Red asked me why.

"A tube checker has its limitations," I told him. "During the test the leak didn't appear because the tube was cold or without load. But in the turned-on set, it was hot and under load, so the leak broke out."

The bellhop drank in my words. "I've got 10 more stops to make, Mr. Margolis," he said, a pleading look in his eyes.

My wife had returned, the kids were gathered around a favorite program, leaving me with a free rainy afternoon. What did I do? I trailed around after Red fixing TVs—and that hooked me. I was busy for several hours daily for the rest of our stay.

As we were finishing our packing to go home at the end of the week, Red appeared in our room followed by a husky porter. He gave me a snappy salute and handed me the bill. A little premature, I thought, until I looked at it and saw the stamp: PAID IN FULL.



## Mystery of the Toy Steering Wheel

THE oversize limousine pulled up at the curb as I was going out on a call. In the back sprawled Mr. Schmidt. With six TV sets in his mansion outside town, he's one of my best customers.

Hank, his chauffeur, sprang out and opened the rear door. When I saw a toy steering wheel installed in the back, I did a double-take. Was our local millionaire, always eccentric, getting childish?

"Come over here, Art," he called. "My receiver is out."

I leaned into the front compartment and turned on the radio.

"No, back here," he bellowed.

I peered in the back and a 17-inch screen stared me in the face. Then I looked up and saw the rooftop antenna. Mr. Schmidt laughed heartily.

"Surprised you, didn't I?" He eased himself out of the car. "Now, fix it."

As I got in the car, Hank explained how the set was powered. A converter in the trunk changed the 12 volts of the car battery into 117-volt, 60-cycle AC.

When I pulled the chassis out of the wall beneath the glass partition and turned it on, none of the tubes lit up. It was a series-type set—one with the tube filaments hooked together as in some Christmas-tree sets. When one filament opens, all go out.

Putting the set down, I went into my

shop to get some new tubes and a little filament checker I use in cases like this. It's a continuity checker—a tube socket wired in series with a battery and bulb. Quite a few of the socket pins are hooked in to the circuitry to accommodate all possible filament-pin combinations.

A good tube in the socket causes the filament pins to complete the circuit. The bulb lights, indicating good filaments. But open filaments won't complete the circuit, and the bulb doesn't light.

After I had checked one tube, Mr. Schmidt snatched at the tester. "Let me do it." He did. Each tube lit the bulb. He snorted. "They're all good!"

"We'll see," I said, and began another check, the long way. I replaced the tubes one by one with new stock. As I put in the 12AX4 damper, the series string lit up.

Mr. Schmidt puffed furiously at his cigar. "That silly test gadget of yours is no good."

"It is good," I said. "But like all test equipment, it sometimes lies."

"Fiddlesticks. And don't put that time you wasted on my bill."

I explained. The 12AX4 tube had developed a filament-to-cathode short. The short had broken the filaments, but one side was still welded to the cathode. When the tube was put in the tester, the

circuit was still completed, not through the filaments but from one side of the filament through the cathode pin.

Mr. Schmidt blew a perfect smoke ring. "I don't know what you're talking about, but order me one of the dinguses and teach Hank so he can use it on long trips."

Hank winked at me as I pushed the set back in place and turned it on. The picture was ghosty, but there was no complaint from Mr. Schmidt as he climbed in behind his toy steering wheel.

The sight of this very successful man sitting with his hands on the miniature wheel was ridiculous. He began to maneuver it. The ghostly picture cleared up into a crisp one. As the car pulled away I looked up, and realized that as Hank drove his boss through town, Mr. Schmidt really was driving, too—a rotatable antenna on the car roof.

## Myth of the Magic Touch

THE story about my being able to check voltages with my fingertips started at the last meeting of our TV association. I had brought my young cousin along, and some of the boys were kidding him. Pete, who is almost as smart as he talks, decided on revenge.

He got his chance when the owner of the shop in which we were meeting admitted he was stuck. On the bench was the chassis of a TV sold exclusively by our big department store. It had developed vertical shrinking and rolling. The high voltage whined.

"I can't find anything wrong with the vertical circuits," said my colleague. He pointed at a spread-out schematic. "All the voltage readings match."

Pete spoke up. "I'll fix it, using Art's secret of measuring voltages with his fingertips." Before I could stop him, he had moistened his fingertips and placed them across two points in the vertical-oscillator circuit. "The plate is way low," he announced.

Going along with the gag, one of the members took a voltmeter reading. "Reads 98," he said, "and that's within tolerance of the schematic's 90."

"Take him back to the nursery, Art," came a voice over the general laughter.

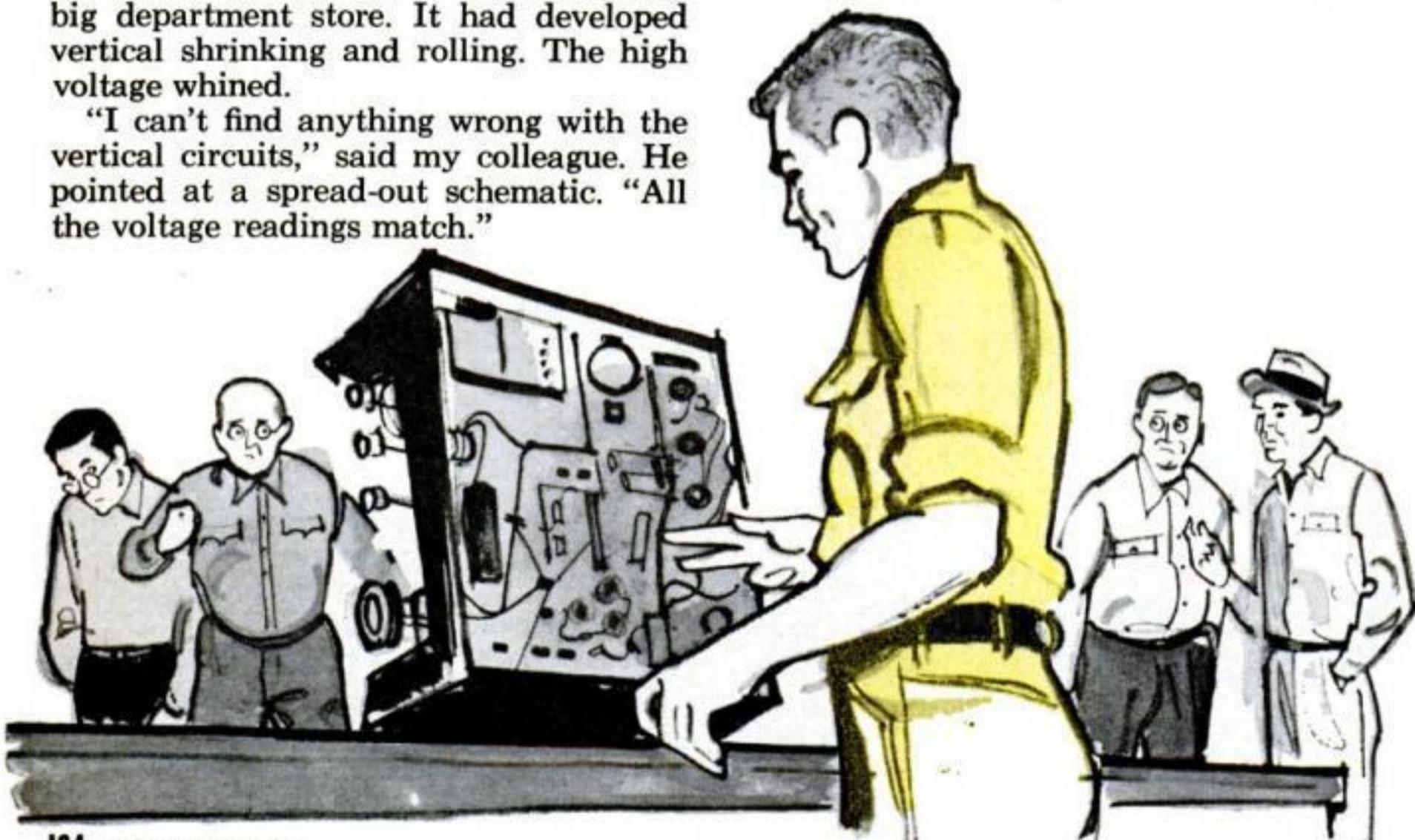
That didn't daunt Pete. He ran his fingers over a couple of plate components, pointed to a resistor, and said, "This one's bad. Its resistance is up."

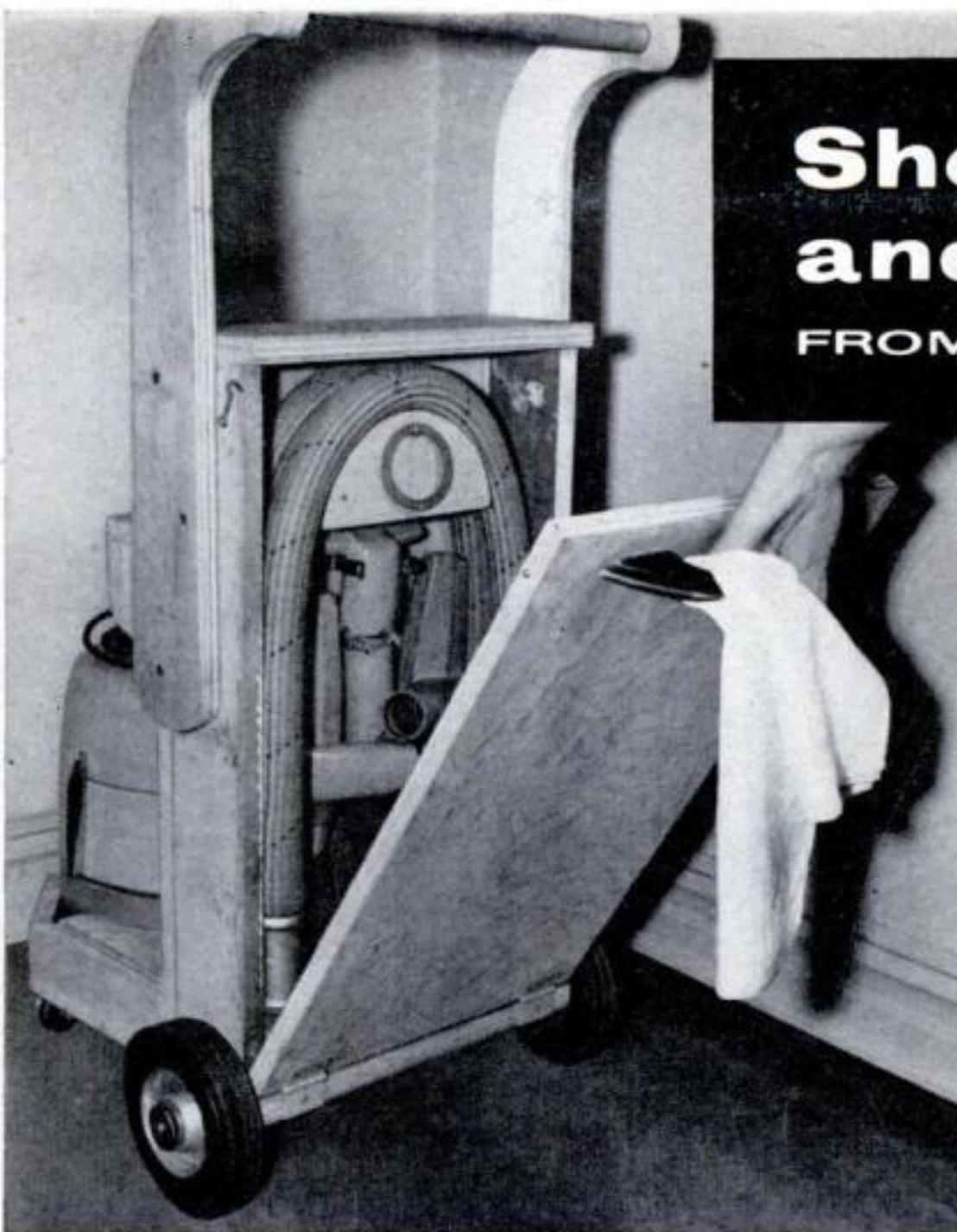
The shop owner, a patient soul, took a reading. The resistor's color code read 56,000 ohms. His measurement read over a million ohms. He quickly replaced the resistor with a new one and the set performed perfectly. A new voltmeter plate reading showed 190 volts.

"But the schematic calls for only 90 volts," protested another serviceman.

Pete, looking smug, rubbed the nails of one hand on his jacket lapel. "Obviously an error in the schematic. You can't expect your test gear to spot that!"

The boy was right, but I knew how he had spotted the mistake. A few days before, I had located the schematic error on the same make of set in my shop—with Pete looking over my shoulder. END





## Short Cuts and Tips

FROM PS READERS



### Caddy for Your Vacuum Cleaner

ALL needed accessories for the vacuum cleaner roll right along with it on this handy wheeled caddy. The long offset handle makes it easy to roll either up or down the stairs.

The body is  $\frac{3}{4}$ " plywood joined with glue and countersunk screws. A base on which the canister cleaner rides is fitted with a 2" high rim and rides on 2" ball-

bearing swivel casters. A  $\frac{1}{2}$ " axle is fastened with conduit straps and fitted with 6" wheels held by cotter pins.

Holes in the caddy base and a shelf above it hold two wands. The hose and other attachments are carried on fitted blocks inside the  $3\frac{1}{2}$ "-deep case. A handle on the hinged lid, which is held shut by a hook, is convenient for dust cloths. Use a broomstick or dowel for a cart handle.—*Robert Wood, White Plains, N.Y.*

### Lock Kidproofs Power Tool

WHEN I bought a new power saw some time ago, my five-year-old youngster immediately solved the problem of inserting the power plug and starting up the saw.

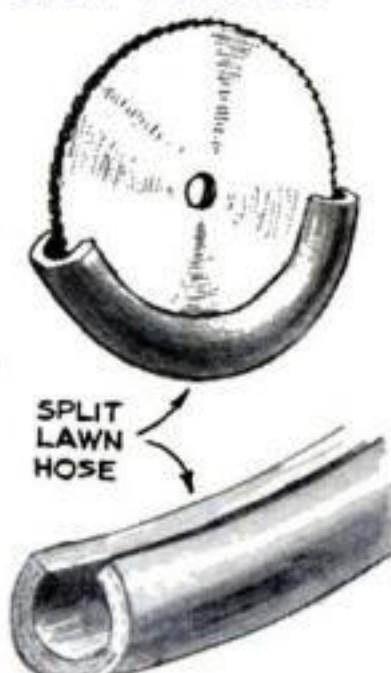
I've foiled him, however, by buying a small dog-collar lock. Each time I remove the plug, I slip the lock through a hole in one prong.—*G. H. Moone, Kensington, Md.*



### Storing Circular-Saw Blades

A SPLIT length of garden hose can be formed into a pocket in which you can put away two or more saw blades without damage to the teeth.

Curve it to the contour of the blades and nail it through one side to the wall or back of the bench.—*M. Robert Beasley, Jackson, Mich.*

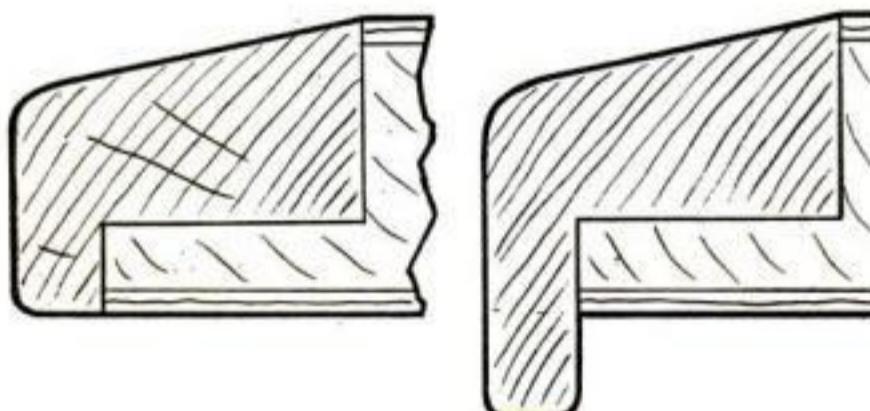
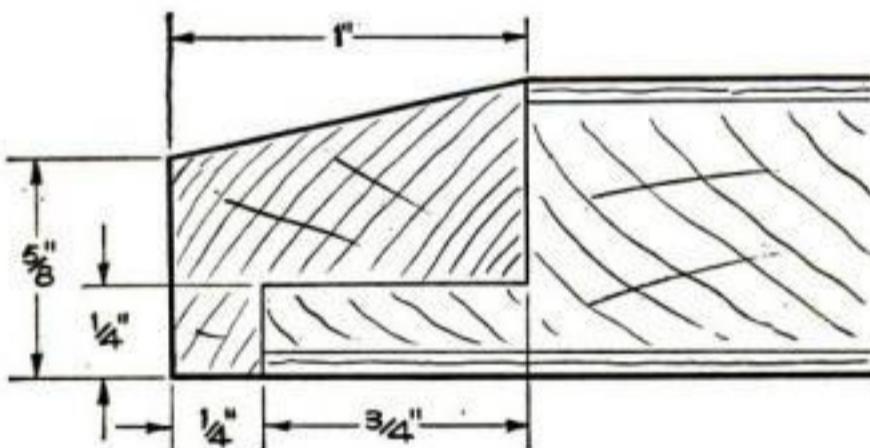


## Short Cuts and Tips

### Handling Film with Gloves

WEAR clean cotton gloves that are free of lint when handling your home movie film. It prevents harmful finger smudges. Wash the gloves in soap or detergent after each use.—*Edmund Ackley, NYC.*

►►►I CUT the top half of the horn ring off my 1957 car. The result is that I can rest my hands in a new, relaxed driving position and see the instrument panel 100 percent better. Taking out five screws, I removed the ring and cut off the top half. Then I filed the cut ends smooth and replaced the ring. The horn ring on other cars may be attached in a different way.—*Walter Kiefer, Hattiesburg, Miss.*



### Edge Molding for Plywood

A PRACTICAL finish for the edges of plywood table and cabinet tops is molding that you can cut and rabbet on the table saw. Or you can make up neat, round molding on a shaper.

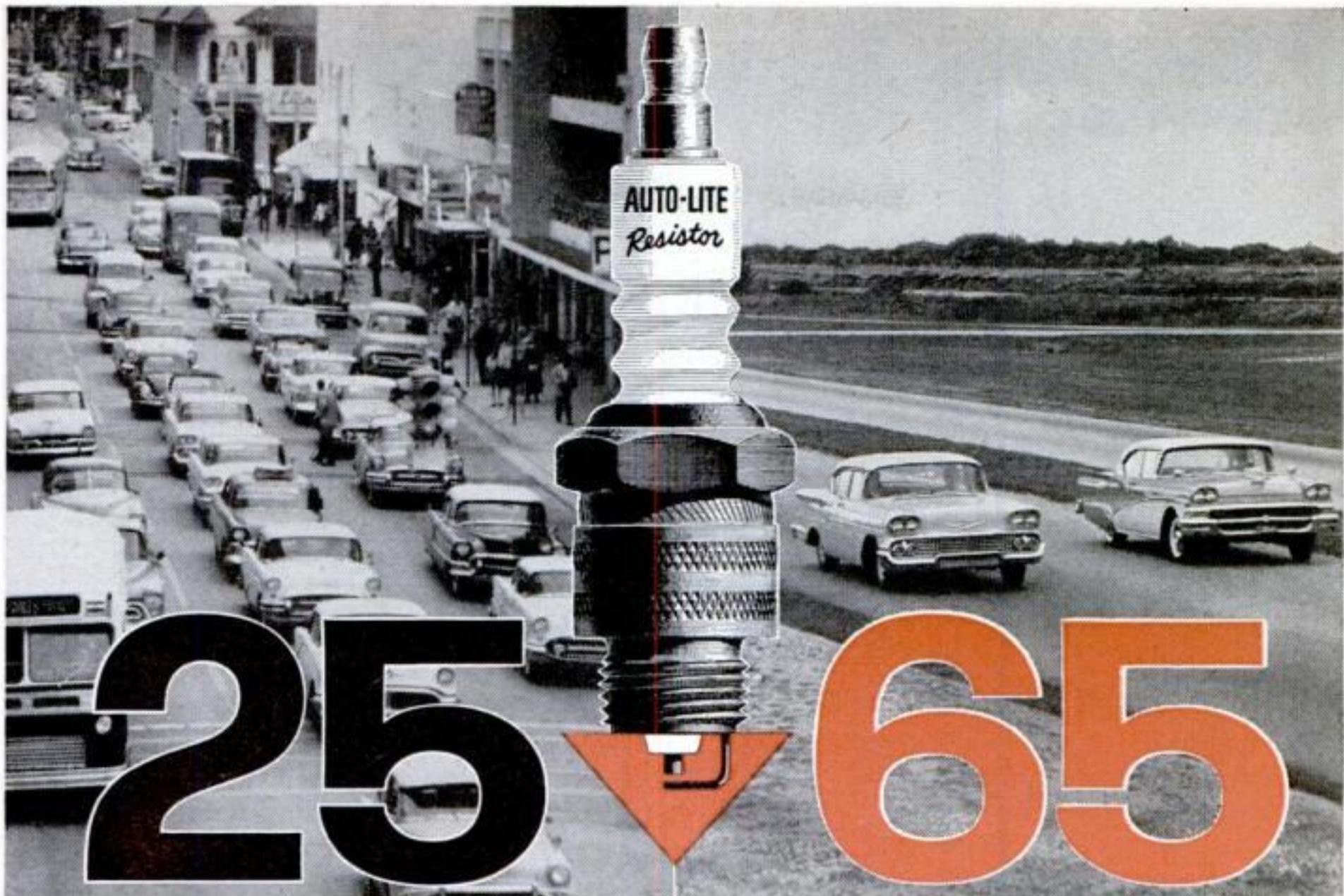
Fasten the molding with glue and nails driven from below, clamping until the glue sets. Miter and round the corners. If a thicker edge is desired, extend the molding below the top.—*Ned Pitts, Dallas.*



### Mirror Is Photography Aid

IF LENS-APERTURE or other markings are on the bottom of your camera, you can read them without upsetting the instrument by means of a small mirror of the kind carried in women's purses. Since it concentrates light, it will also prove a focusing aid when lighting is poor.

Put it in your gadget bag along with the filters or tape it to the exposure meter.—*Glen F. Stillwell, Manhattan Beach, Cal.*



**25**  **65**

**IN TOWN TRAFFIC . . .** some spark plugs, designed for high speeds, become fouled and cause misfiring and loss of power when driven at low speeds.

**ON THE HIGHWAY . . .** some spark plugs, designed for low speeds, misfire causing power loss and invite destructive pre-ignition when driven at high speeds. Why gamble when . . .

## Auto-Lite Resistor Spark Plugs with **POWER TIP** “Fire Up” your engine\* at all speeds!



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At low speeds, the projecting Power Tip is in the thick of combustion where it gets hot quicker and stays hot to burn fouling deposits away clean. At higher speeds, the projecting tip is in the path of the incoming air-fuel mixture where it stays cooler to effectively *check* power-robbing pre-ignition. Ask your garage or service station to install Auto-Lite . . . the *only* spark plugs with Power Tip . . . and start enjoying top performance and economy from your car at *all* speeds.

\*Power Tip, with or without Resistor, is ignition-engineered for overhead-valve V-8 engines and for most overhead-valve 6-cylinder engines in all these cars—Buick, Cadillac, Chevrolet, Chrysler, De Soto, Dodge, Edsel, Ford, Hudson, Imperial, Lincoln, Mercury, Oldsmobile, Nash, Packard, Plymouth, Pontiac, Rambler, Studebaker.

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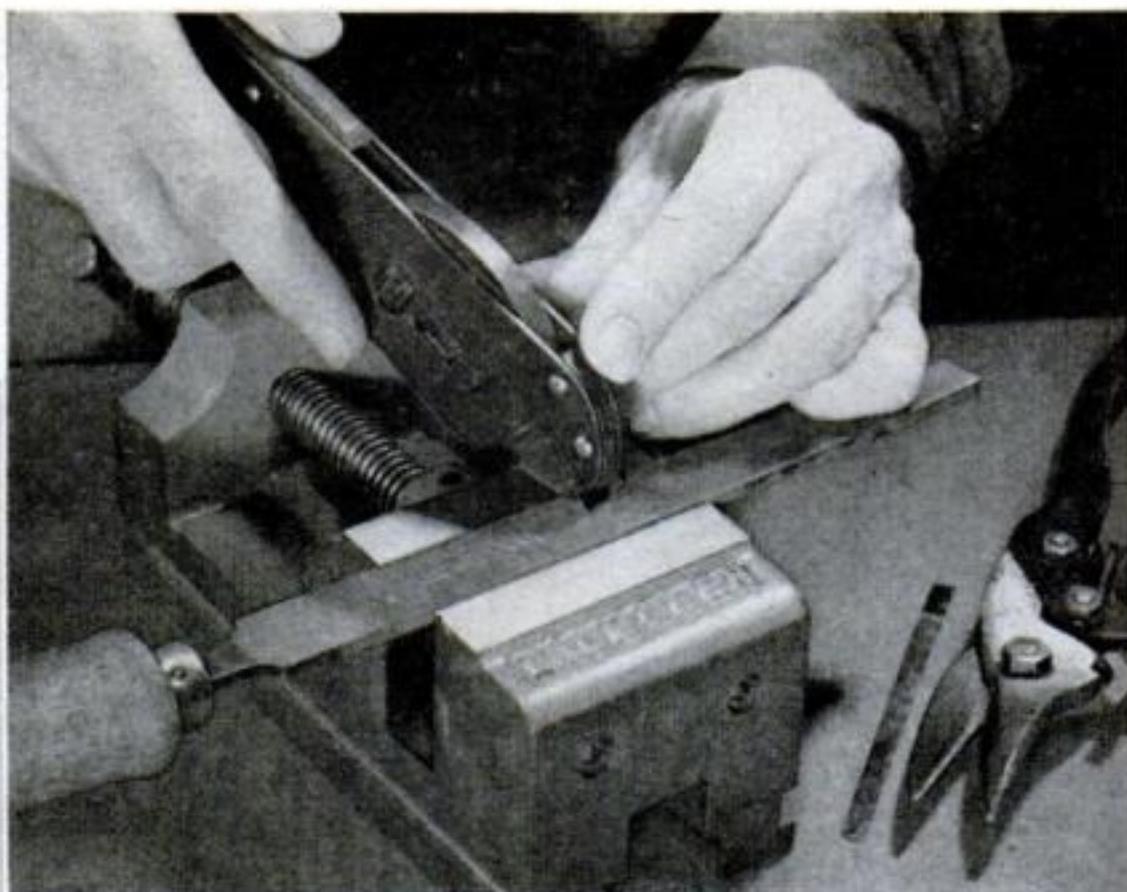
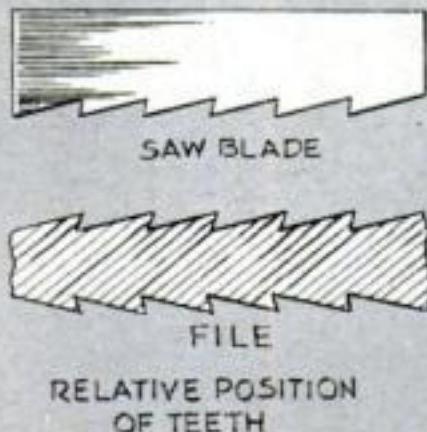
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## Short Cuts and Tips



### Removing Soft Metal from File

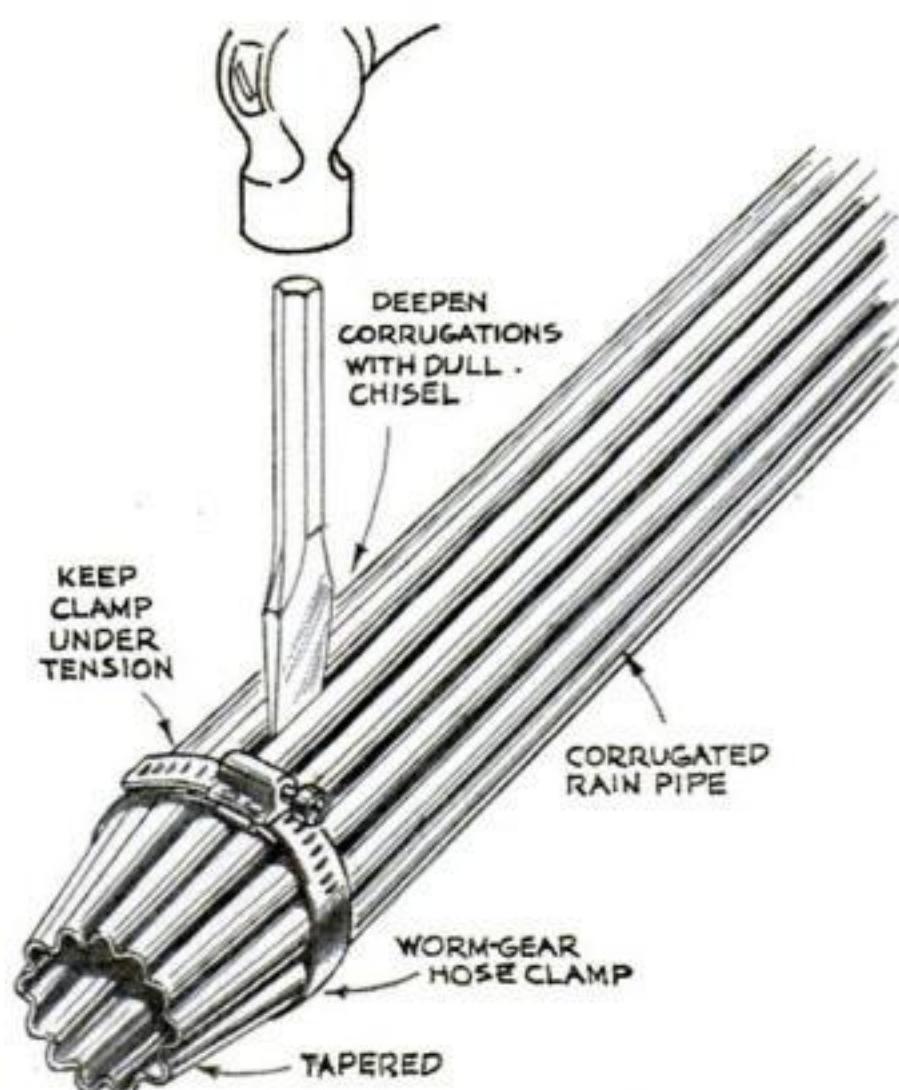
A FILE clogged with lead or other soft metal can be cleaned with a short length of fine-toothed hacksaw blade. Grip the piece of blade, teeth down, with pliers

and scrape it across the file, parallel with the file grooves. After one piece of blade becomes badly worn, replace it with another. Brush out the loose particles.  
—Walter E. Burton, Akron, Ohio.



### Natural Knotholes for Birds

WHEN I saw the first spring birds, I got an idea. I dug into my scrap lumber ends and selected pieces discarded because of knotholes. They make natural bird-house entrances, easier than cutting circles. The birds seem to like them, too.  
—John W. Walker, High Point, N.C.



### Tapering End of Rain Pipe

A WORM-GEAR hose clamp will squeeze the end of rain pipe into a taper so you can fit it into the next section without straining. First deepen the corrugations in the pipe with a dull cold chisel, and then tighten the clamp until the taper is set.—Andrew Vena, Philadelphia.



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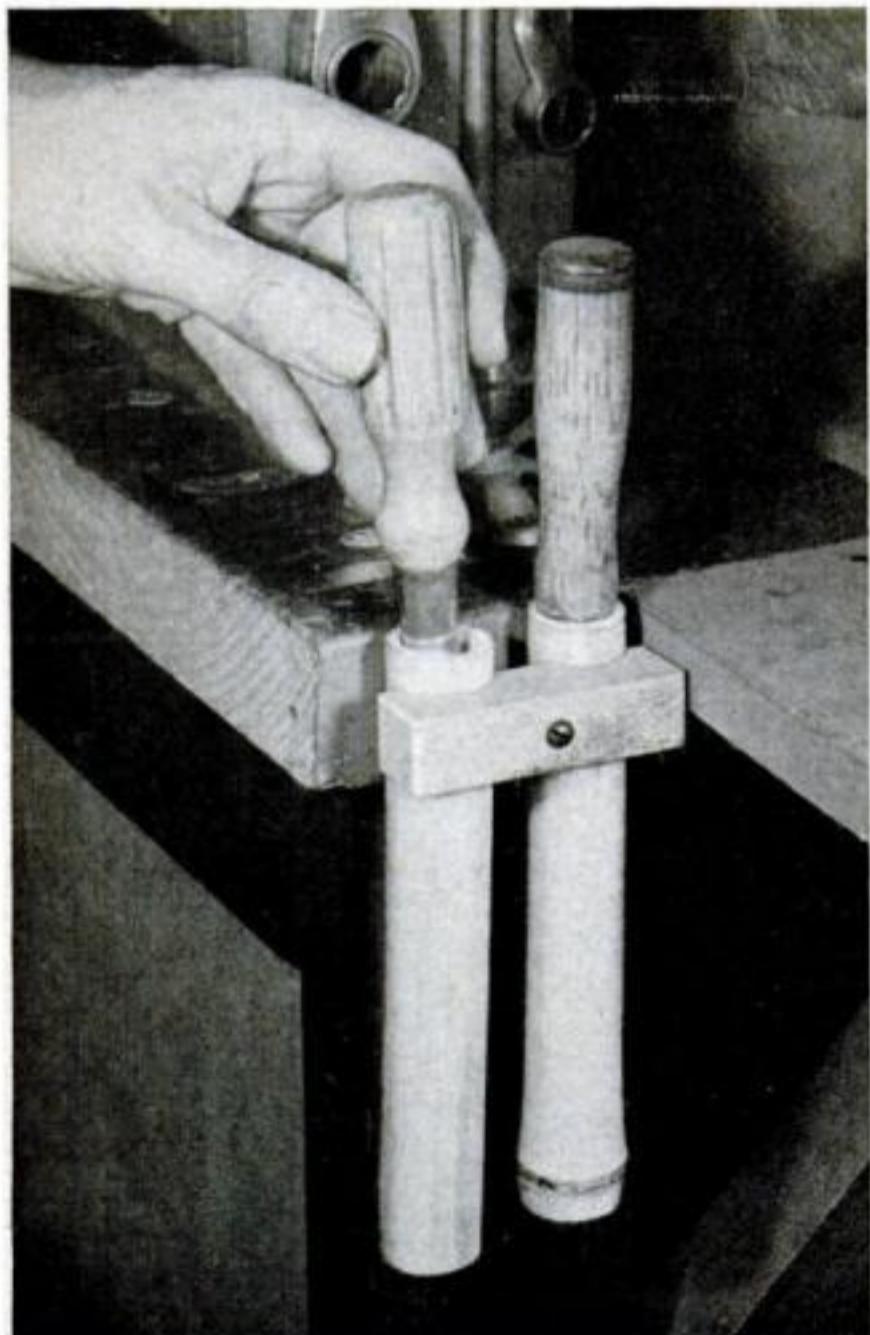
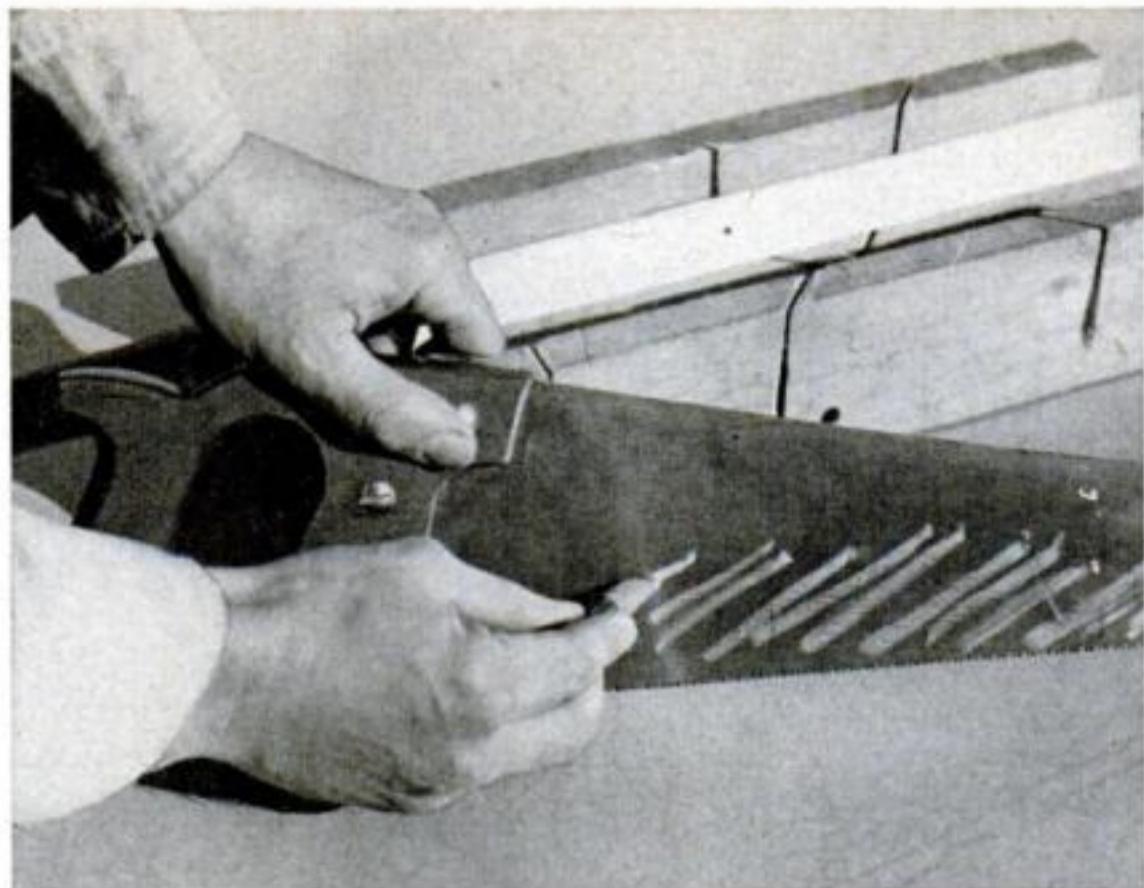


## Short Cuts and Tips

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### Wax Rubbed on Saw Will End Chatter

BINDING and chattering in a miter box will be reduced if you wax the sides of the saw before using it. A few strokes with a wax stick provide a lubricant that eases sawing and won't discolor the work.—*Joe W. Rocke, Huron, S.D.*



### Bamboo Tool Holsters

SECTIONS cut from a discarded bamboo porch chair or an old fishing pole will hold screwdrivers, chisels and other frequently used hand tools if you mount them on the wall or the end of the bench.

They can be left open at the ends, but if slender handles slip through, plug the bottoms.—*Wallace Brown, Cleveland, Ohio.*

►►►AN OLD sewing-machine needle, made a press fit in a small hole drilled in the end of a length of dowel, is a handy tool for cleaning the nozzle of your paint sprayer.—*Fred Davenport, Newark, N.J.*



### Paper "Brush" for Touch-Ups

WHEN a touch-up brush isn't available, you can use 2"-by-3" strips of newspaper tightly rolled into narrow cones. Form a fine point at one end and wet this slightly to get a working edge. The throwaway brush works well on autos, furniture and the like. It stripes on lines better than bristles.—*Tetsuo Otsu, Vancouver, B.C.*

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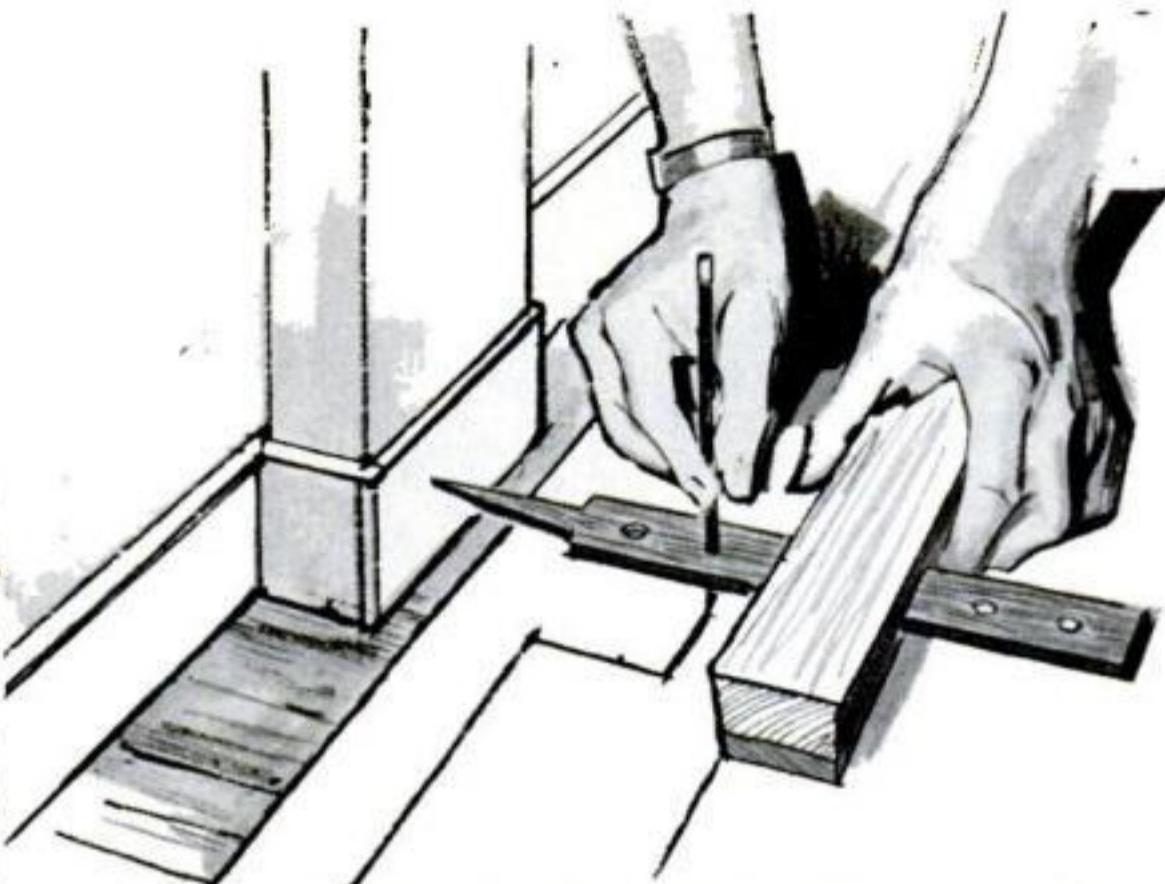
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## Short Cuts and Tips

### Homemade Scriber for Making Patterns

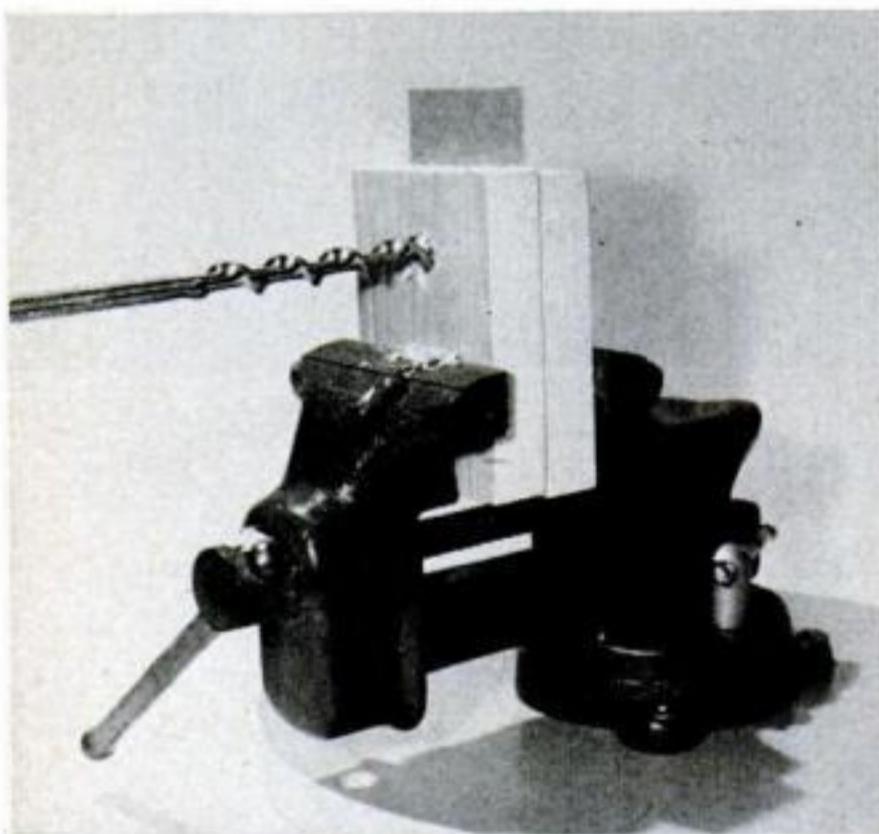
BEFORE you lay linoleum or flooring, or put up wall covering, the new material must be cut to fit around irregularities at the edge of the surface being covered. A scribe I made will draw an exact outline of irregularities directly on the new material or on a pattern. This simplifies cutting the edge of the material so that it will fit flush neatly.

The scribe is simply a slotted wood block in which a wooden pointer slides. I made the pointer by sawing a point on the end of a piece of  $\frac{3}{8}$ "-by-1" stock 10" long, and in it I drilled a series of  $\frac{3}{8}$ "



holes spaced so as to allow several positions for the scribing pencil.

The block was made from a 6" length of two-by-three and a similar piece of one-by-three. I notched one 3" face of the thicker block to a sliding fit for the pointer and tacked the one-by-three on that side.—*E. L. Britt, Westport, Conn.*

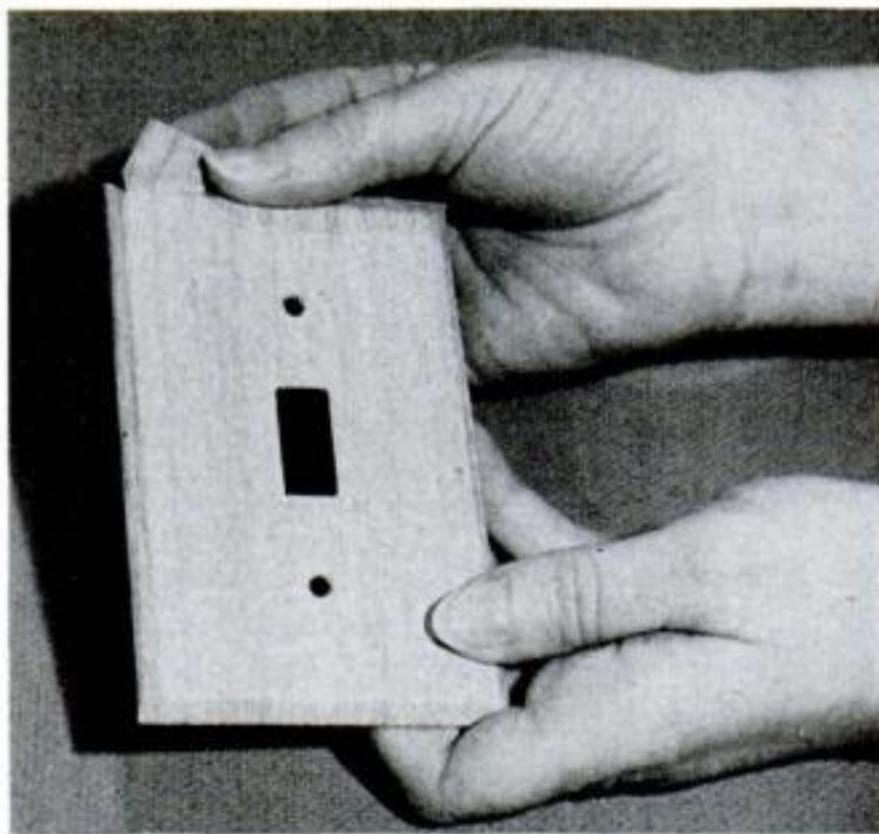


### Drilling Thin Stock in Sandwich

A CLEAN hole is hard to drill in thin plywood or shim metal unless you back it. You can avoid damage by sandwiching the work between scraps before drilling.

—*F. A. Jenks, New Brunswick, N.J.*

►►► You can even up the surface of a worn oilstone fast by rubbing it on a concrete sidewalk. Wet the sidewalk first. If the concrete is too smooth, sprinkle fine sand on it.—*Clarence H. Witte, Affton, Mo.*



### Switch Plate Matches Wall

THE adhesive-backed plastic used to cover tables, counters and walls will also cover a tarnished switch plate, or match it closely with a wood-finished wall.

Cut a piece of the plastic just larger than the plate. Miter the corners and cut holes for switch and screws with a razor blade. Fold the excess plastic over the back of the plate, keeping it smooth so the plate will lie flat on the wall.—*Frank A. Jorgenson, North Arlington, N.J.*

# CHEVY'S new FULL COIL SUSPENSION tamed this nightmare trail over the Andes!

Imagine a rock corkscrew two miles high!—that's the terrifying General San Martin Highway across the Andes. Twice Chevrolet slammed over this gullied boulder-strewn trail in its record 41-hour run across South America and back. And every foot of the way Chevy's new Full Coil suspension performed seeming miracles, taking the jounce out of chuckholes, holding the car true and level around wild curves, smothering fist-size stones in its deep resiliency, checking front-end "dive" in braking. The test-drivers were convinced this four-coil suspension, with its unique arms to control the rear axle, is the finest springing ever achieved in Chevrolet's class. When you drive the '58 Chevy we think you'll agree—on the boulevard or over the roughest back road you can find! . . .

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**CHEVROLET**



Corkscrew turns furnished convincing test of Full Coil stability, were no strain even for 98-pound girl co-driver.

## *Midnight Ride on the New Turnpike*

*[Continued from page 30]*

Orange, Conn., check station, having made 42 miles in 50 minutes—including three toll stops. Instead of 15 m.p.h., we'd averaged 50.

As we pulled up to the Park Diner for supper, Steve said:

"Nothing ever wakes Cherrypie while we're rolling. But see how long it takes him to wake up when I cut the switch."

He cut the switch. Before the Thermodyne had even stopped spinning I heard a deep sigh. The green bunk curtains parted and a bearded face peered out.

"Hi," said Cherrypie. He was in his undershirt.

As we strolled toward the check station in a garage, Steve kicked each of our 16 tires casually. "Can you really tell that way if they're soft?" I asked.

"You don't tell by feel," he said. "You tell by sound. A soft tire gives a thud. A good one rings."

*Our tires rang* like 16 bells. Steve signed the register, looked to see who'd been there today, and hunted for orders. There were none. We washed and headed for the brightly lighted diner.

"Steve," I said, "is it true that any diner where you see trucks is a good one?"

"Yes," he said, "90 percent of the time. But you've got to remember: We look for other things besides good food. We like quick service. And we like to be able to park right outside the door—not way down the lot the way you do at the turnpike restaurants."

Cherrypie joined us. Under the lights he proved to be a big, quiet fellow with a pleasant grin. He was shaved now and had a shirt on. We ordered steak sandwiches and coffee—and cherry pie.

Cherrypie ate in silence. Finally he said: "Did you meet anybody?" We'd passed three Carolina trucks but had recognized only one driver.

"Well, I saw John Aderholt," said Steve, gulping coffee. He explained to me: "We always like to know who passed while we slept."

*Out on the road again*, Cherrypie took the wheel, and I hit the sack. I wanted to see what sleeping on a truck was like. I didn't sleep—but I easily could have.

It was a big, comfortable bunk with clean sheets. I slid in, pulled the cur-

tains and stretched out. It was snug and quiet in there, and the big diesel sounded far away.

Remembering Steve, I rolled out presently and turned the bunk over to him.

"He'll be asleep in half a mile," said Cherrypie. "Want to know something? I sleep quicker in that thing than I do in my own bed at home."

*Midnight*. Montville tollgate, in a blaze of lights. Cherrypie handed down 75 cents and we began a long climb.

"Only one thing wrong with this pike," he said. "They should have put the toll-gates on top of the hills."

It began to rain. He flipped the FWC switch for safety. Presently the rain stopped. A woman alone in a blue Mercury convertible overtook us, but on the next downgrade we came up behind her.

"I won't pass her," Cherrypie said. "This wet road will slop up her windshield." (Honest, that's what he said!)

I thought of something. "It bothers me," I said, "to have a truck suddenly appear behind my rear bumper as I start up a hill."

"Don't worry," he said. "He won't hit you and he isn't trying to be funny. He's just trying to squeeze every possible mile of speed on his run to make the hill. Just a little delay means a lot."

"Does it help you, then, if a car speeds up on a hill?"

"Sometimes—but it's better, generally, if drivers don't try to help us. We figure your speed. We plan carefully and gauge when we can pass. If you change speed, it just messes us up."

We whipped along. I noticed Cherrypie was steering not by the rim of the wheel but by the 10-o'clock spoke. His left elbow rested comfortably on the rim. His right hand, as always, hovered over the gear controls.

"You fellows like this life?" I asked.

"Gets into your blood," said Cherrypie. "You know something? We call this tractor 'her.' I don't know why, but I guess that proves something." He patted the wheel. "I've got a little girl at home now, and I'd like to be home more, but I still like the road."

Steve, I knew, also had a little girl and a small son. He and Cherrypie are life-long friends and neighbors back in Caro-

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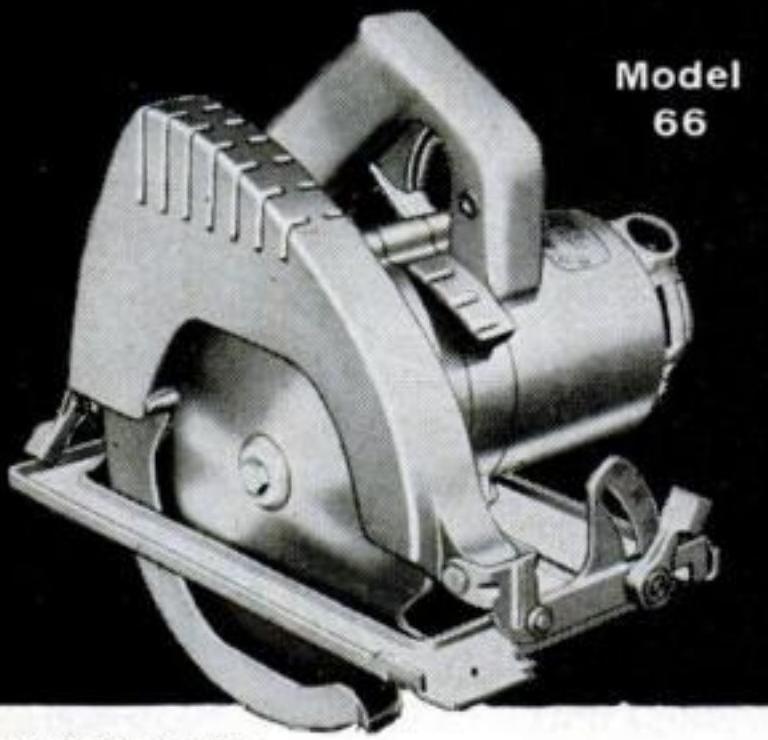
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PS-8

## Midnight Ride on the New Turnpike

lina. Cherrypie grows roses and tomatoes. But when he gets home, he also likes, for recreation, to drive his car!

"Anybody on the road you don't like?" I asked.

"The drunk is our only enemy," he said. "Truck drivers report them now. Steve even helped a cop catch one."

At 1:10 a.m. we rolled off the Pike, into Rhode Island, and headed for Providence and U. S. 1 again.

**2:50 a.m.** A truck blinked lights at us. "Oh-oh," said Cherrypie. "The law's around." Soon we saw red blinkers. The law was there but so was a wrecker. We slowed and rolled past just as a dazed young fellow crawled up the bank from a smashed convertible. We went on.

U. S. 1 was empty. Once, though, on a narrow strip a truck pulled out of a line of trucks coming toward us and threatened to run us off the road. Cherrypie was ready for him. He hit his brakes and gave the careless guy a chance to get back in line.

"There's one thing motorists can do to help us," he said. "If you see we've miscalculated and are trapped, help us pull back in line fast."

Once a prowler got on our tail for a while outside Providence. But our speed was reasonable for the hour and he soon pulled ahead.

**3:30 a.m.** We pulled into Medford, on the Boston outskirts, and drew up at an all-night diner.

Cherrypie kept the diesel idling so it would stay hot. He jammed a fusee-type stick flare between the accelerator and a clamp on the steering column. "That will hold her down," he said. "If I don't brace the pedal, she idles at 500 r.p.m. I like her to idle at 1,000."

"What difference does it make?" I asked.

He grinned. "Well, we've found that 1,000 revs won't disturb your sleep. But at 500 r.p.m. the sheet tickles your nose and wakes you up."

We had breakfast, and at four a.m., exactly on time, rolled into Carolina's deserted terminal at Medford. Steve slept on in his bunk. I looked around for a cab to take me in to Boston. Cherrypie hit for the dormitory to continue the slumbers he had interrupted 52.4 miles before midnight.

END

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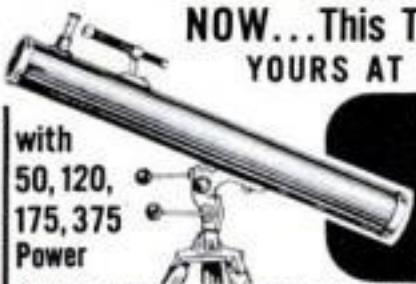
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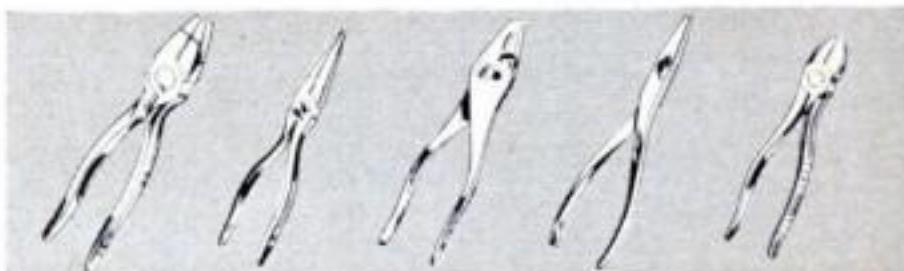
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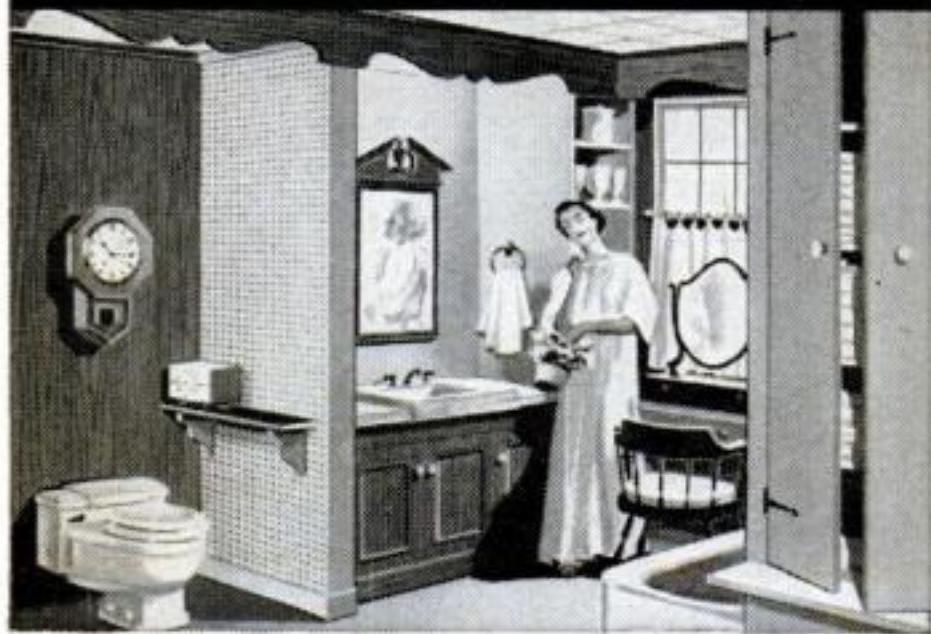
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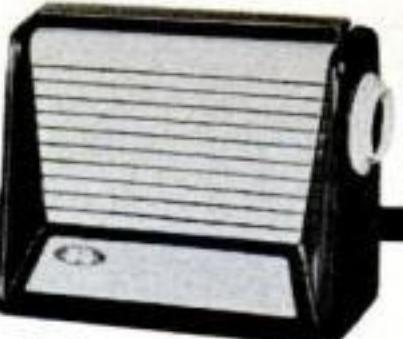
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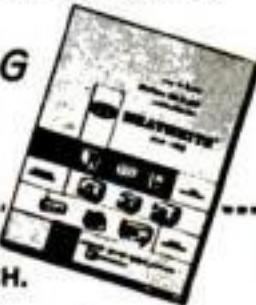
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## The Big 'I's' of Atomic Power

[Continued from page 74]

are a coal-rich country: It is estimated that we have nearly half the coal in the world. Taking into account future increases in power demands, we should have enough fossil fuels at reasonable prices to last us for at least 160 years. The U. S. Geological Survey states that our coal reserves "will last for many generations," and is now exploring coal areas in search of a firmer figure.

**Who needs it?** In Britain, on the other hand, where coal is costly and dwindling, there is a grim need for a new source of power, and they have logically launched an atomic-power program which in a few years will dwarf our own. Atomic plants producing about one million kilowatts are expected to be operating in 1960, and further plans call for a total of five to six million kilowatts by 1966. These plants, and others throughout the power-hungry world, should pay their way long before ours do, and while we burn our cheap coal it should not shake our national pride to see other nations resort to a substitute that is still tricky and uncertain.

At least a score of nuclear experts in government and industry whom I have interviewed are unanimous in stating that as far as our domestic needs are concerned, there is no point in a big atomic-power program.

"It is obvious that with our fuel reserves, we won't need atomic power for some time," said Lewis L. Strauss, then AEC Commissioner. "My reason for an accelerated program beyond the natural growth of the industry is based on the needs of our friends overseas. We lead the world in the development of atomic reactors of various kinds, in our search for the cheapest, safest and most efficient design. We should pursue this program vigorously to see if we can arrive at competitive power years before it would come about naturally. If we don't do it, others will. Such a program cannot be self-liquidating, any more than Fulton's Clermont was. Many new plants, large and small, need to be built, and if private industry cannot build them, then it should be done with government money. But there should be less and less need for government participation except for research."

**Another bone of contention** is the perennial battle between private and public

### **The Big 'I's' of Atomic Power**

power. While private utilities cannot pay the cost of harnessing the working atom and concede that it is a government job, they suspect that a big federal program will breed a public power monopoly; others protest that taxpayers should not be asked to build plants for private firms. Numerous compromises have been proposed. Since we need building experience rather than quick atomic power, many suggest that we finance and build plants abroad where power needs are more urgent. The AEC is now discussing such a plan with Euratom (European Atomic Energy Community) which would involve U. S. technical and financial aid in building four to six plants to be fired with U. S. enriched fuel.

**Still unsolved** is the problem of how the world will safely dispose of the hundreds of millions of gallons of highly radioactive waste which plants will turn out every year when the atomic-power program really gets going. Arnold Joseph of the Sanitary Engineering Section of the AEC's Division of Reactor Development estimates that if, at the expected rate of industrial expansion, 10 percent of our electric power comes from the atom in 2,000 A. D., the annual waste from U. S. plants, after the unused fuel is reclaimed, might run to 41 tons of hot fission products. These would be contained in perhaps 50 million gallons of gunk—the equal in radioactivity of more than 30,000 tons of radium. Other forecasts run much higher.

At today's infant stage of atomic power the problem is under strict control. About 65 million gallons of the gunk is now stored in huge, steel, concrete-encased underground tanks, mostly in an atomic graveyard at Hanford, Wash. But it will take 600 years for the waste to cool off to safe levels of radiation. Meanwhile, several methods which may lead to safe, cheap disposal are being investigated. Because of its wealth of coal, the United States has time to wrestle with the problem, but radiation is no respecter of boundaries, and as plants proliferate throughout the world, international disposal regulations will become imperative. At present, the only honest answer anyone can make to this and a hundred other enigmas of the nuclear age is, "Nobody knows, but we're working on it." **END**

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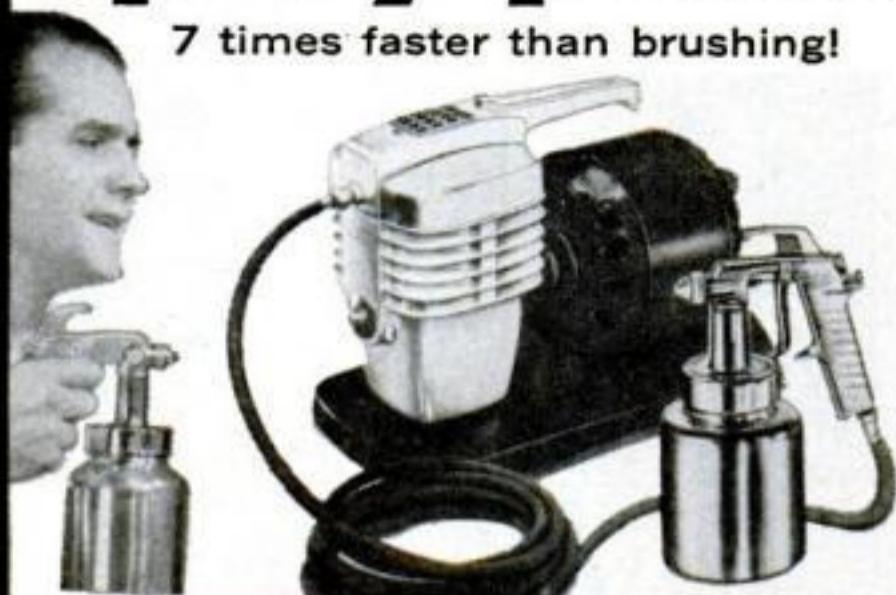
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**Putting Speed in a Champion Speedboat**  
[Continued from page 106]

He struck up an acquaintance with the late Stan Sayres and in 1942 offered to design an unlimited hydro for Sayres without charge, in return for the privilege of driving it through the mile, the Gold Cup, and the Harmsworth trophy race. That first boat was Slo-Mo IV.

In 1951 Jones set up his own shop in Seattle to make Slo-Mo V. Today his business is designing and building fast boats. Later this year, as a by-product of the design of unlimiteds, he will start production of a three-point outboard. This little outboard, carrying three men in choppy water, turned up 78 m.p.h. in an early spin in Florida.

**Three-point racers ride on air**, which has far less friction than water. They touch water at only three points: the after ends of the two sponsons and one blade of the prop. At 165 m.p.h. the prop lifts about 750 pounds, but the sponsons carry no weight; they provide only balancing while the boat rides along on air.

As an illustration of the saving in power with a three-pointer: The fastest Gar Wood hit in the days before Slo-Mo IV was 124 m.p.h., and that with four supercharged engines turning up 7,600 hp.—the power of a B-29 bomber. But three-pointer hydroplanes hit far greater speeds with only 2,000 hp., and at 124 m.p.h. use only 700 to 800 hp.

**Beyond this year?** Jones looks to much faster speeds in racing and with a completely different source of power—the jet engine such as is used to drive the Boeing B-47 bomber.

Miss Bardahl's present engine turns up 4,200 r.p.m. The gearbox steps this up to the astonishing prop speed of 11,550 r.p.m. I remarked that it was too bad the driver could not shift gears. Jones grinned. "Right. Two speeds in the gearbox, one for the turns and another for the straight-away, would be a driver's dream."

**A hydraulic mechanism** might do the job, but the cost would be prohibitive and the box would weigh too much to be practical in racing, Jones believes. "The prop and the gearbox are the limiting features in today's big hydroplanes," he says. "The hull itself is good for at least 235 m.p.h., but we can't get a prop that will stay together at those speeds. That's why the jet engine looks so good." END

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### When to Trade In Your Car

[Continued from page 108]

to reline brakes only once in a 45,000-mile trade-in span.

A less obvious sign of vehicle senility is creeping engine inefficiency. Any car past the 50,000-mile mark will average fewer miles per gallon than in its youth. A two-mile drop (12 to 14 percent in low-priced cars) is not uncommon. This shows on no repair bill, but costs you, week after week, at the gas pump.

**The key to the question** whether any particular repair or replacement is worth making is depreciation. The chart on page 109 gives each year's depreciation, what the total adds up to in any ownership year, and the average-per-year loss to you if you trade in a car any time from one to 10 years after you buy it.

To see how it works, take an unhappy example from my own experience. Until I talked with Runzheimer and Howard, I was confidently trying to see how long I could wheel my 1951 Plymouth station wagon. Now it's plain that I am paying extra money to hang on to my old car.

Instead of averaging all the depreciation, I went blithely along in the belief that it was costing me a couple of hundred dollars a year in lowered value, plus a little for repairs. I did not total all the work I had done in any 12-month period, so I never realized how repair costs were mounting. Looking back, I find they had reached \$460 at the five-year mark.

At that point, as the chart shows, ownership had cost me \$365 a year in depreciation plus \$92 a year in repairs (averaged over the five years). That's a grand total of \$457 a year.

The next year the rear end and clutch began to act up, a spring cracked, and I faced a major overhaul. The dealer suggested I trade on the spot, but I stubbornly refused and told his mechanic to get busy. (If I had done the work myself, the figures would be different, of course.) But that bill came to \$197 and a few months later I had to sink more money into tires, a muffler, plugs and points.

By the end of that year, the car had cost me an average of \$479 annually instead of the \$457 it had the year before. I would have saved money by trading instead of repairing!

Let's look at other possibilities. If I had traded once a year, I'd have spent \$800

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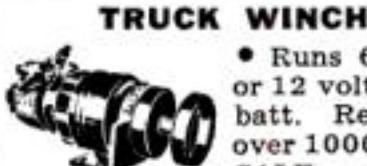
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### When to Trade In Your Car

for depreciation and next to nothing for repairs. This is even harder on the pocketbook than keeping a car too long, but loads more fun. (Percentagewise, Cadillacs decline in value more slowly the first two years than any other American car, so they are a bargain in one-year trading if you can afford one. If you can't, try the Volkswagen for size; it too has a slow depreciation and thus a low one-year trade cost.)

*By trading every third year*, I would have averaged \$458 in depreciation. With a total of \$172 for repairs and replacements in that period, the average annual cost of ownership would have been \$515, or \$285 less than one-year trading. That saving would pay the *total* bill for operating my car 3,000 miles or three months.

Finally, by trading at 45,000 miles, I would have escaped all my high-priced repairs except a new clutch. To make expensive repairs worth while, you usually have to drive your old car another two years—and even then it pays off only if you are lucky enough not to have additional expenses. This is where your firsthand knowledge of the car is useful. A clutch that wears out on a two-year-old car may be an isolated failure—or only one result of rough usage that has also taken toll of the transmission, brakes and rear end, making further repairs likely soon.

One way to decide whether to repair or trade is to reduce your estimate of the value of your car by the cost of needed work. This is the system recommended by Howard.

*The unpredictable joker* in the car-trading deal is inflation. The depreciation charts show how much your car drops in value, but not how much more a new one may cost you. In the lifetime of my own old wagon, comparable models have increased in price by several hundred dollars.

The net increase will depend on such factors as the size of the discount you get, taxes, and the local car market. But the long-term trend has been steadily upward. The longer you cling to your old car, the harder you're likely to be hit by inflation when you finally buy. If you trade regularly, at least you'll swallow this expensive medicine in considerably smaller doses.

END

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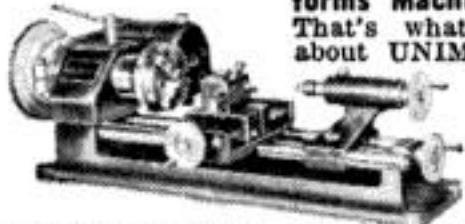


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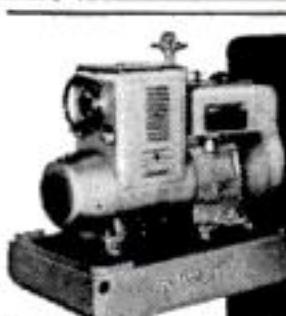
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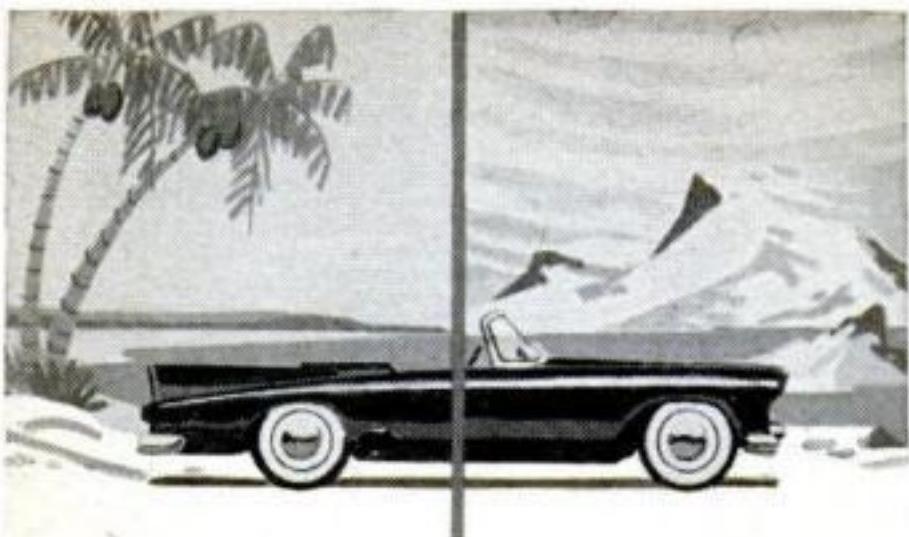
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### Electricity Without Generators

[Continued from page 56]

The Russians, who have said nothing about vacuum-tube heat converters (or submarine engines), are not reticent about their very high-grade work on solid thermoelements. One recent American paper on thermoelectricity cites dozens of Russian references. The Soviets apparently use the solid devices in their Sputniks, and they claim to have in commercial production an electronic refrigerator (the solid units work very well in reverse, consuming electricity to produce heat at one end, cold at the other).

**They are practical now.** Even in the handmade laboratory stage, these heat converters look so good that product-development people are itching to get their hands on them.

Both the vacuum-tube and solid units now deliver about 10-percent efficiency. If that doesn't sound like much, remember that an automobile engine runs only 30-percent efficient. It's plenty for jobs

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where you don't mind wasting some cheap heat, or where heat is a byproduct anyway. For instance:

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- Compact power sources—for lights or appliances—burning canned propane, kerosene, corncobs or buffalo chips.
- Airplane power plants to utilize the heat wasted by jet-engine exhausts.

Ten-percent efficiency isn't enough to excite utility engineers, who pinch hundredths of a penny. But the vacuum-tube converter can theoretically achieve

# HOW TO TURN Concrete INTO Gold



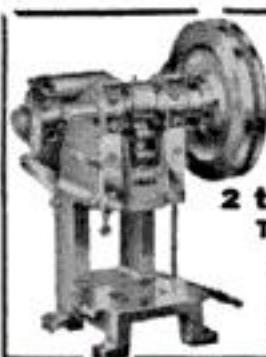
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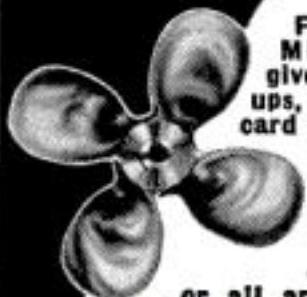
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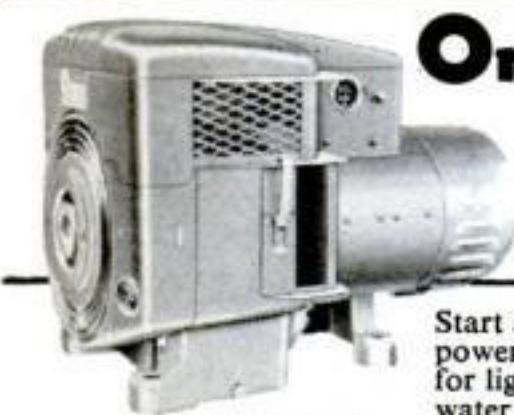
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### Electricity Without Generators

carried away in the hydrogen stream).

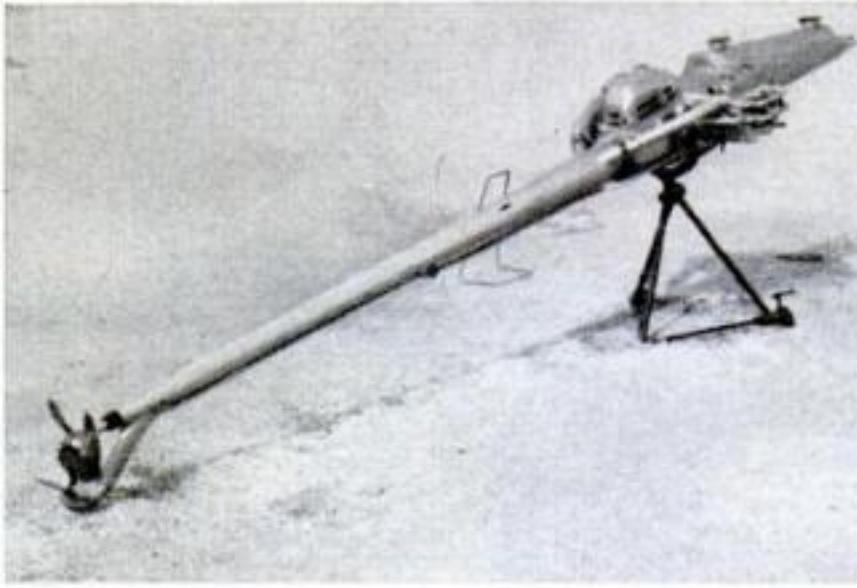
This simple package delivers plenty of power (250 watts per cubic foot of cell, not counting fuel tanks) at high efficiency (80 percent). There's no heat or pressure. And you can run it on cooking gas (instead of hydrogen) and air (instead of oxygen) if you have to. It works, but not as well.

Raising temperature and pressure increases output. This has been done by another company, Patterson, Moos Research, for its Hydrox unit. Running at 800 pounds pressure and 464 degrees, it produces three kilowatts from a setup only 28 by 16 by 14 inches—including tanks with fuel for six hours' operation.

Such small cells make good portable power plants, useful for airplanes, radar sets, industrial trucks. Big units—the kind utilities need—require very cheap fuel, which means coal or coal gases. This in turn requires very high temperatures (1,000 to 1,800 degrees) and that brings complications. No one is willing to forecast quick success, although top-rank scientists are working on the idea in the U. S. (particularly at Pittsburgh Consolidation Coal Co.), Russia, England and Holland.

END

### Outboard holds prop at angle



THIS 14-foot-long outboard motor puts 30 hp. aboard a big boat. The Hungarian power pack is said to propel a barge or a 10-passenger boat at more than 17 knots. The long shaft drops into the water at a shallow angle and the prop rams cooling water through it to the motor. A flat gas tank serves as a steering tiller, too.

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SURPLUS U.S. Navy INFRA-RED RECEIVER**

INFRA-RED EQUIPMENT lets you receive invisible beam in pitch black darkness. Govt. cost \$300 approx. Factory-new. Type B Eastman Kodak Infra-Red Metascope Receiver, 7" long, with 5" Schmidt ultra-high speed object lens. Elaborate optical system, many coated lenses. Uses 2 penlight batteries. Shipping weight 9 lbs. Price \$19.95. Waterproof Metascope Carrying Case, extra. Shipping wt. 3 lbs. Price \$3.00.



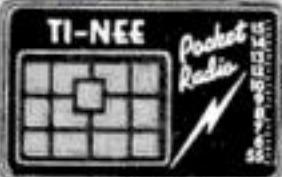
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Send full amount with order. All equipment shipped F.O.B. Pasadena, Calif.

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C-10

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Semisteel sets approx. 10% higher.  
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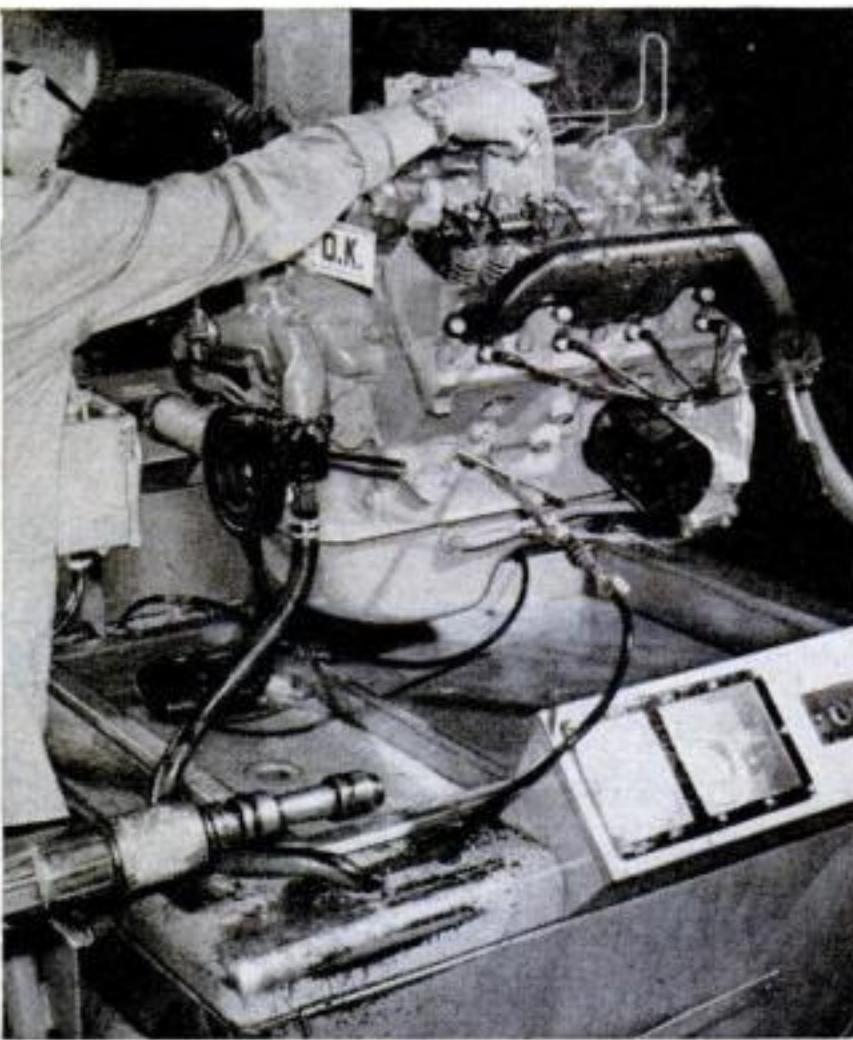
**6**

SIZES



### Inflatable boat puts out fires

THREE pumps are carried by this inflatable rubber craft put into operation by the British Auxiliary Fire Service. The new fireboat is shown here at massed exercises on the Serpentine, a London lake.



### Engine balanced by electronics

THE box at left is a stroboscope used to balance engines on the Ford assembly line. Another detects vibration at the rear. They were devised by International Research and Development, Columbus, Ohio.

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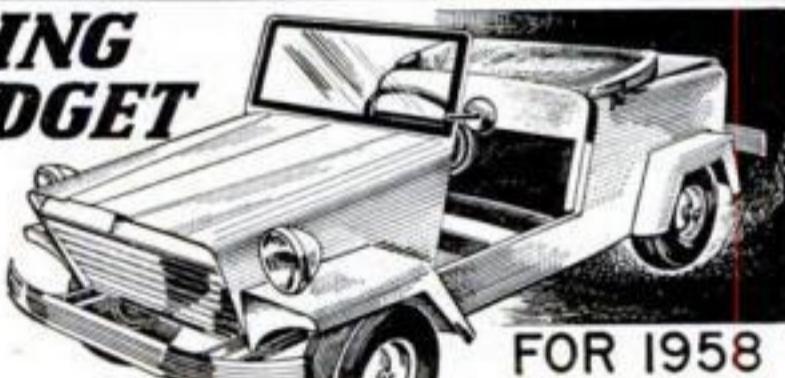
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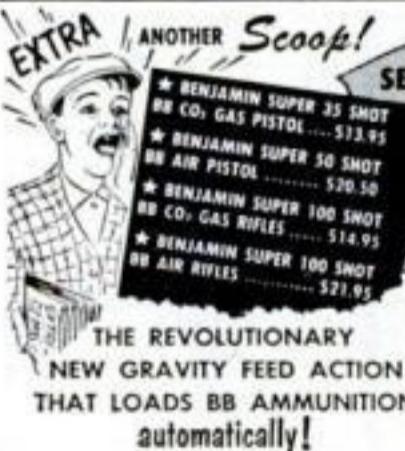
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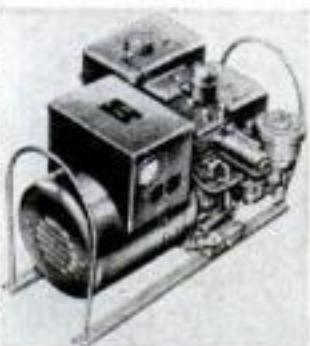
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### The Wonderful One-Lung Engine

[Continued from page 70]

could control engine speed closely, and if you were really hep you could flip the engine to reverse without stopping it. "Throw off switch," said the instructions, "and when engine is near to last revolution or nearly on center, throw on switch again." A knob on the flywheel starting handle, which was aligned with the crank throw, gave the doughty mariner his cue for this maneuver—a pulse-quickenning sport in tight corners.

About the same time, in the Midwest, John Lauson of New Holstein, Wis., was pondering an Otto engine he had seen. Although a boilermaker, Lauson saw the advantages of a power plant that needed no tending of a fire or the water in a gauge glass. In 1896 he built a four-cycle, four-horsepower machine with hot-tube ignition (shown on page 66).

Soon he was selling one-lungers of three to 50 horsepower for farm use. Later models were water-cooled by an open hopper cast around the cylinder. In this way, Lauson eliminated easily frozen pipes and water pumps. He abandoned hot-tube ignition for his own make-and-break igniter, and later offered "jump-spark" or high-voltage ignition as optional on small engines. This had the trembler coil (with vibrating breaker points) and Cuno timer of Model T Ford fame.

**Today they're different.** The four-cycle engine has a cam for each valve and an air vane or flyball governor working the throttle. On old-timers, what you might take for the intake push rod tripped the make-and-break flipper; the intake valve was not worked by a cam, but opened by atmospheric pressure as the piston moved out.

The exhaust-valve push rod had a tricky connection with the flywheel governor. If the engine exceeded speed, this would simply hold the exhaust valve open. Gulping only air, the engine missed some power strokes and slowed down.

Today's engines would balk at any fuel but gas. But lower speeds and less finicky carburetors allowed old-timers to putt along on kerosene or alcohol. One Palmer boat engine had a two-way fuel valve and a flat head that ran hot. If you switched to kerosene (which has a lower flash point than gasoline) you had to shut off the ignition a mile out of port, for the head

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For use wherever it is necessary to protect the clothes or body from mud, silt, moisture, etc. Made to top Gov't specifications of rubberized canvas. Has vulcanized seams. **1288** & built-in rubber gloves and boots. Sizes: Sm., Med., Lg.



**12 Pcs.  
SPORTS  
KNIFE**  
5-5/8" HANDLE

Eliminate 12 items from your pack. Ideal for Sportsmen, Hunters, Campers, Hikers, Boy Scouts, etc. Includes a standard knife, a fork, spoon, draw-knife, bone saw, fish scaler, scissors, a can and bottle opener, cork screw, awl punch, screwdriver and metal file. All this plus a leather belt holster.

**JUNGLE HAMMOCK****688**

A genuine U.S. Marine Corps Jungle Hammock. Ideal for use by Campers, Hunters, etc. Has built-in mosquito bar with a zipper opening. Tent type, waterproof cover. Accommodates a full size man. Hammock is of weather-proof rain coating.

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Portable ARMY PICMATTOCK—Has 12" steel head with mattock & pick . . . \$1.29

Portable ARMY FOLDING SHOVEL—20" handle. Ideal emergency shovel. . . \$1.79

G.I. MACHETE w/22" Vanadium blade \$1.98 to cut down for diving or hunting knife. \$2.98

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PACK RACK**  
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TAX

Has an extra lightweight tubular steel frame. Originally designed for the British Army. The frame has a canvas covered, fold-down pack shelf at the bottom. Rack is designed so that weight is carried at the hips. Folds flat.

**U.S. Army Lensatic POCKET COMPASS \$3.49****NAVY FIGHTING KNIFE** with 6-1/2" fine steel blade & leather holster . . . . . \$2.98**17" Army BAYONET & SCABBARD** — Ideal

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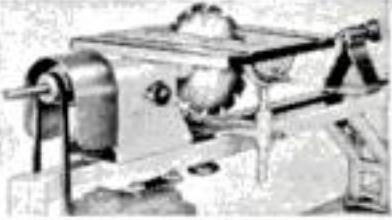
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**SENDS—RECEIVES UP TO 10 MILES AS SHOWN** with built-in antenna or hundreds of miles with outside antenna! Works on 80 and 40 meter (Novice) amateur radio bands—also Aircraft and overseas broadcast (3 to 8 me). **PORTABLE SELF-CONTAINED POWERED WITH STANDARD PORTABLE RADIO BATTERIES. NO AC PLUG-INS NEEDED!** Take it with you everywhere you go—on trips, vacations, camping—Keep in contact with home, friends. Has 5 watt crystal controlled transmitter—Sensitive Regenerative Receiver. Send-Receive switch. Wt. only 3 lbs. Size, only 6" x 4" x 4". **TESTED—PROVEN—SIMPLIFIED—PRACTICAL**—Full information given on quick easy way to get license.

**SEND ONLY \$3** (bill, ck, mso) and pay postman \$12.95 COD postage on arrival or send \$15.95 for postpaid delivery. Complete kit includes all parts, tube, coils, plastic cabinet, easy instructions. (Set of batteries \$3.49; crystal \$1.49.) **COMPLETELY WIRED AND TESTED. POSTPAID \$19.95.** A regular \$49.95 value—Order now before price goes up. **GUARANTEED—AVAILABLE ONLY FROM: WESTERN RADIO, Dept. BNS-8, Kearney, Nebr.**

**RETAIL PRICE \$125.00****FACTORY TO YOU \$79.95**

**SUPERSHOP** includes precision-built 8" tilting table saw, vertical and horizontal drill press, 30" lathe, sander, grinder. **100% BALL BEARING.** Write for FREE catalog, full details, trial plan.

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BEOLOIT, WISC.****FABULOUS, NEW****5-Ft. Long Balloons****Twist Into A Thousand Shapes!****GIRAFFES-DACHSHUNDS—Pets of All Kinds**

Made of  
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**200 FOR \$1**

Add 25c  
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**Delight Kiddies—Grown-Ups, Too!****Almost 5 feet long when inflated. Balloons this size usually sell up to 25c each.**

Send only \$1 now. Plus 25c postage and handling for 200 in a variety of gay colors! Supply limited at this low price, so order several sets NOW for GUARANTEED PROMPT DELIVERY. **MONEY BACK GUARANTEE.** FREE Compete Instructions.

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**STOP FRONT DRIVE DRAG IN 2 W. D.**

Warn Hubs on your 4 w. d. disengage the front drive in 2 w. d., give it double-duty value with free-wheeling 2 w. d. economy, performance, plus normal 4 w. d.—automatically, with Warn Lock-O-Matics, manually with Warn Locking Hubs. See your dealer soon!

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**WARN HUBS**

# Shrinks Hemorrhoids New Way Without Surgery

Science Finds Healing Substance That Relieves Pain—Shrinks Hemorrhoids

For the first time science has found a new healing substance with the astonishing ability to shrink hemorrhoids and to relieve pain—without surgery.

In case after case, while gently relieving pain, actual reduction (shrinkage) took place.

Most amazing of all—results were so thorough that sufferers made astonishing statements like "Piles have ceased to be a problem!"

The secret is a new healing substance (Bio-Dyne\*)—discovery of a world-famous research institute.

This substance is now available in suppository or ointment form under the name Preparation H.\* Ask for it at all drug counters—money back guarantee.

\*Reg. U.S. Pat. Off.



## CLOGGED SEWERS? CLEANED INSTANTLY SAVES PLUMBING BILLS —

CHICAGO—July 1st. Just introduced is a Free Booklet & New Discovery which enables the Home Owner, Janitor, or Factory Maintenance to clean any Clogged Sewer Drain.

Yet anyone can operate this new Plumbers Flushing Gun which releases air pressure on a solid shaft of water cleaning the most stubborn stoppages up to 200 feet. TOILETS, SINKS, URINALS, BATHTUBS, FLOOR DRAINS, and HOUSE-TO-STREET SEWERS clogged with Grease, Rags, Sand, Roots, and paper melt away instantly when struck by the Hammer-like blow of this new unit.

There is no need to remove wall or pipe, or Grease Trap. A special attachment allows water to flow from the faucet through the Gun while air is released on the pipe. Vents or stacks are no obstacle, as force tends to strike wherever the water lays. But now, what is this Plumbers Flushing Gun worth in COSTLY PLUMBING BILLS SAVED? Tear this Ad out—and write your name and address beside it for FREE BOOKLET. Obey that urge. No agent will call. A postcard will do (Chicago Phone Kildare 5-1702) MILLER SEWER ROD CO., DEPT. PS-M, 4640 N. Central Ave., Chicago 30, Illinois.

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FILER  
NO. 9  
SO EASY to joint and file saws like new. Two hardened steel rollers keep teeth same height. All teeth cut, saw runs true and smooth. \$2.95 ppd.

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For both hand and circular saws. Steel rollers give all teeth correct height, pitch and bevel. \$9.95 ppd.

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Automatically sets teeth at 10° or more. \$2.95 ppd.  
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No. S-300 Kit of Flat Bars 5 Pairs (10 Magnets)	.....	\$3.00
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Send M.O. or check. We pay postage. Sorry no C.O.D.'s.

MIAMI MAGNET COMPANY, 3240 N.W. 27th Ave., Miami 42, Fla.

## The Wonderful One-Lung Engine

would fire it that long and there was no way to stop it.

*A motor on rails* was the goal of C. N. Teetor of Hagerstown, Ind. In 1893 his Light Inspection Car Company began building pedal-operated rail cars for railroad trackmen. Soon the need for an engine was felt.

With his brother John, Teetor made one in 1895. It had manifold fuel injection; three cams to work the fuel pump, exhaust valve, and ignition; and a ratchet to keep a backfire from turning the cams backward and so wrecking the lot.

"It ran, but it shook the daylights out of the car," says Ralph Teetor, John's son and dean of today's Perfect Circle Company. Engine number two had two pistons working opposite each other in one cylinder with the combustion chamber between. By 1904, after unsuccessful experiments with steam engines, Teetor's car company was selling stationary as well as mobile gas engines.

**First putt-putt mower.** Though blind, Ralph Teetor followed in his father's inventive footsteps. In 1923 he put a one-lung, two-cycle engine on a mower with the idea of marketing such a machine. "Nobody," mower manufacturers told him, "would pay a hundred dollars to mow the lawn." He gave up the idea. (He also invented a vacuum shift used on Hudson-Essex cars in the '30s, and more recently the Auto-Pilot on Chrysler cars.)

Briggs and Stratton became identified with engines when they bought the Smith Motor Wheel in 1918. This was an air-cooled engine built into a rubber-tired wheel. Hitched behind a bike, it afforded push without pedals.

B and S eliminated the external magneto, built it into the flywheel, and sold motor wheels until stiff licensing laws reduced their teen-age market. Seeking other uses for the engine, they put it on a mower early in the '20s, then added an external fan and rope starter to adapt it to washing machines.

This overhead-valve engine of 2½-inch bore and 2½-inch stroke was rated one horsepower at 2,200 r.p.m. "It stood so high we had to put the washing machine on stilts," says Fred Stratton. "That engine weighed 45 pounds."

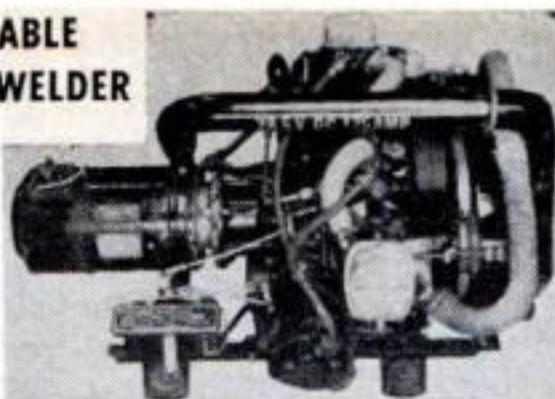
Today, a typical four-cycle engine rated 1¾ horse at 3,200 r.p.m. has a bore

**200 Amp. PORTABLE  
GASOLINE ENGINE WELDER**

Government Cost \$2,940.00

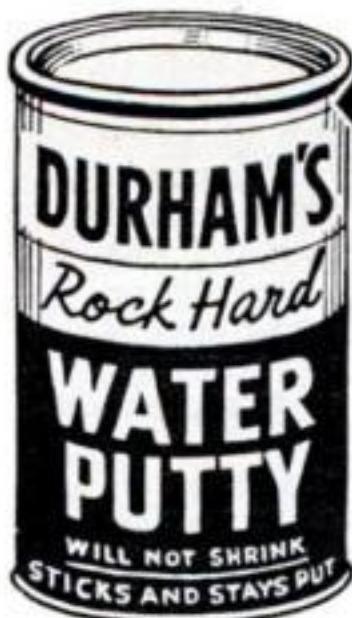
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Most compact welder obtainable for the big jobs in out of the way places. Generator is capable of delivery of double overload or continuous service at 200 Amps. use up to  $\frac{1}{4}$ " welding rod. Engine is manufactured by Ranger Aircraft and is 2 cylinder, 4 cycle 10 H.P. at 3200 RPM. Fully governed for varying loads. Unit is shipped complete with rheostat for varying load. You need to supply only cables and electrodes for welding. Units weigh approx. 150 lbs. (less oil & gasoline) and are approx. 22" W x 33 $\frac{1}{2}$ " L x 17" H. All units used but guaranteed and checked before shipment. Parts available both new and used.



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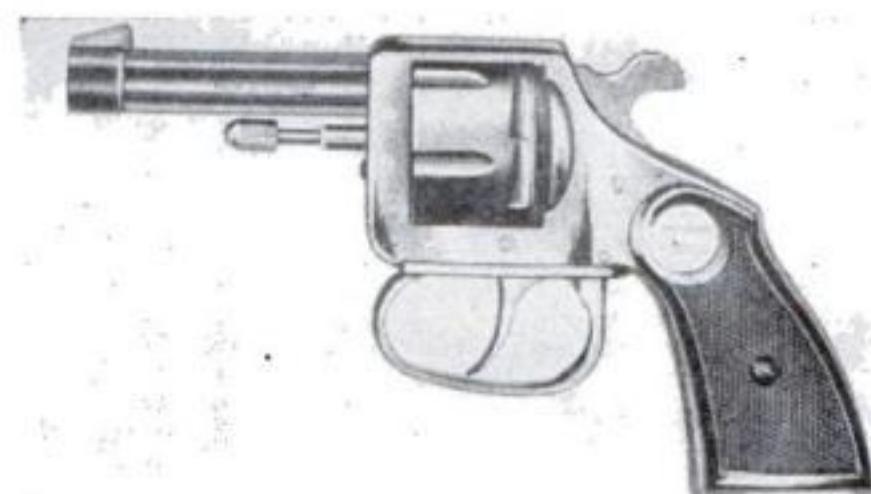
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It's actually easy to save money—when you buy United States Series E Savings Bonds through the automatic Payroll Savings Plan where you work!

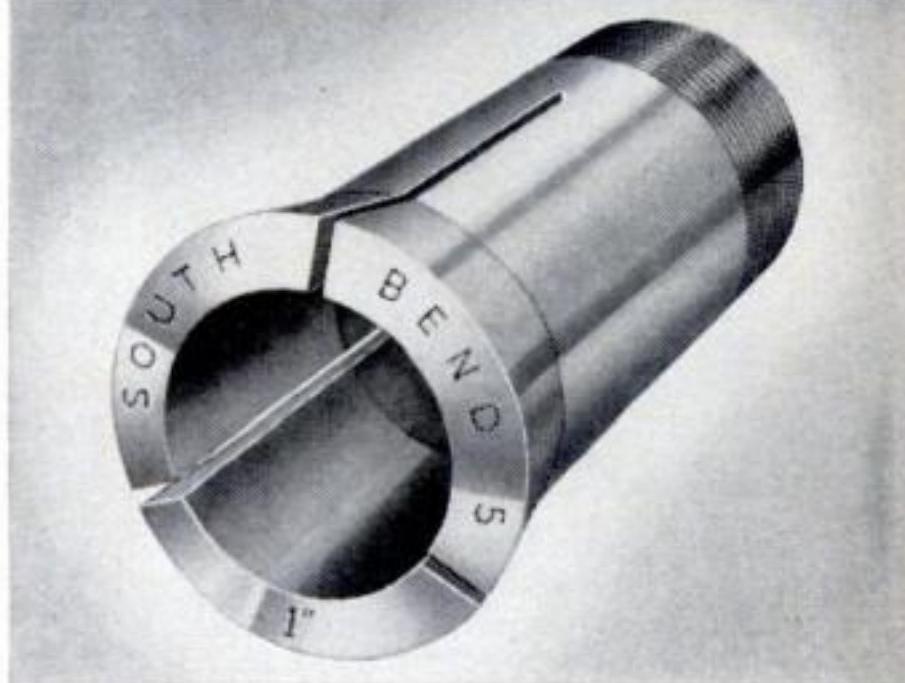


**ROSCOE VEST POCKET .22—\$12.95** Brand new 6-shot German revolver that sells in the \$28 - \$30 range. A tight accurate well-made piece. 3" Bbl., 5" overall. Fires popular American made .22 short ammo. Side gate loading. Has a fine steel rifled barrel with blade front sight. Excellent for target or plinking. 10-day money-back guar. \$12.95. For C.O.D. send \$7.50 deposit. Leather holster \$2.25. Send check, cash or M.O. to: **SEAPORT TRADERS, INC.**, Dept. PS-8, 409 E. 12th St., Los Angeles 15, Calif.

(Advertisement)

# SOUTH BEND COLLETS

GRIP TRUE • RUN TRUE • STAY TRUE



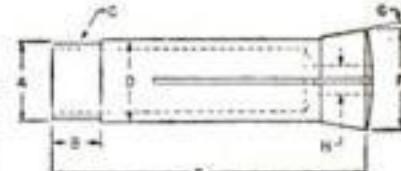
**RED ARROW STEEL COLLETS**—Threads ground from solid after hardening for exceptional accuracy, strength and durability. Carefully machined for extremely accurate concentricity, true centering and dependability. These precision collets bring out the best in any machine.

**BRASS COLLETS**—Ideal for infrequently used sizes or holding soft stock. Readily machined for tapers or irregular shapes. Easily reborred when worn.

### Specifications

#### of South Bend Collets

Popular sizes shown in table. Nos. 2 and 4 available from stock. South Bend Collets are interchangeable with 2-A, 3-C, 4-C and 5-C. Write for complete information.



Collet No.	3	6-K	5
Sizes of Lathes Used On	9"	10-K	10", 13", 14 $\frac{1}{2}$ ", 16", 16-24", 2-H, 1 $\frac{1}{16}$ " col.
A. Thread Diameter, in.	.642	.767	1.242
B. Thread Length, in.	$\frac{3}{4}$	$\frac{21}{32}$	$\frac{3}{4}$
C. Threads per in.	26	26	20
D. Body Diameter, in.	.6495	.8425	1.2495
E. Collet Length, in.	2 $\frac{11}{16}$	3	3 $\frac{1}{2}$ "
F. Head Diameter, in.	.852	1.160	1.452
G. Angle of Head, degree	12	15	10
H. Maximum Capacity, in.	$\frac{1}{4}$	$\frac{5}{8}$	$1\frac{1}{16}$
PRICES	{ Red Arrow	\$4.80	\$5.95
	{ Brass	\$1.95	\$3.20

**SIZES:**  $\frac{1}{16}$ " to capacity by  $\frac{1}{64}$ " increments. Sets by 16ths, 32nds, and 64ths. Decimal and metric hole sizes and square or hexagonal holes at slightly higher prices.

**SOUTH BEND LATHE**  
**SOUTH BEND 22, INDIANA**

Building Better Tools Since 1906.



Up to 24 months to pay.

## **Educators Honor Popular Science for "Distinguished Coverage"**



*PS Senior Editor Martin Mann, who coordinated award-winning articles, receives bronze plaque at convention from NEA's Miss Sylvia Ciernick.*

ANOTHER coveted prize for journalistic achievement — the 1958 School Bell Award — has been granted POPULAR SCIENCE. The National Education Association, representing school officials and teachers, honored POPULAR SCIENCE for the series "Straight Talk to Parents." These articles, published last year, provided straightforward information to help parents guide their children toward useful and profitable careers.

The NEA selected four articles for citation as "distinguished coverage of schools during the school year 1957-58 by a monthly magazine aimed at a specialized audience." The articles were "You Can Afford to Send Your Child to College," (Aug.) by Vance Packard; "How Well Does Your Youngster's School Teach Science?" (Oct.) and "How Good are the Science Labs in Your Youngster's School?" (Nov.) by John Kord Lagemann; and "How Good are the Shops in Your Youngster's School?" (Dec.) by Erik H. Arctander.

The School Bell Award bronze plaque and scroll is the second honor that these articles have received recently. Only two weeks before the NEA annual convention in Cleveland, at which the award was made, POPULAR SCIENCE had accepted the year's most important magazine honor, the gold medal of the Benjamin Franklin Award for public service.

In addition, POPULAR SCIENCE has won two other major prizes this year: the "Maggie" of the Pacific Coast Independent Magazine Wholesalers Association; and the National Safety Council award — eighth in a row for PS — for contributions to safety.

### **The Wonderful One-Lung Engine**

much larger than its stroke ( $2\frac{5}{8}$  by  $1\frac{1}{2}$  inches). It weighs 21 pounds—12 pounds per horsepower instead of 45.

"Prices have changed, too," Stratton points out. "Cost per horsepower now is one-seventh what it was 25 years ago."

**Improvements gained momentum.** Piston stroke was shortened, shaft speed increased. Weight was cut with aluminum and magnesium castings. Lubrication, once spottily provided by oil cups, came of age with splash and force-feed systems. (In two-cycle engines, it was Palmer who pioneered in mixing oil with the gas.)

Carburetors were improved, air cleaners added. Better magnetos and automatic spark advance were introduced. Cooling was aided with flywheel blowers and shrouds around the block.

The two-cycle engine had to overcome years of ill repute when it was considered unreliable and hard-starting. Ball-and-needle bearings, better crankshaft sealing, its extra power stroke and inherently simple design now make it a rugged contender against the four-cycle engine.

The Clinton Machine Company, makers of gears for hydraulic mechanisms

during the war, turned out a  $1\frac{1}{2}$ -hp. two-cycle engine as their first peacetime product. Now this company builds as many as 3,000 engines a day.

Power Products Corporation got its start when Robert Krueger and a partner began building a small  $\frac{3}{4}$ -hp. engine in 1946. Its lightness adapted it to mowers, scooters and bikes. But first success almost swamped the venture; mower makers installed hundreds of engines before finding them inadequate for the job.

**Bigger engines saved the day,** and the company rode to success on the growing popularity of the rotary mower. Today it offers standard as well as high-performance engines. Some can run in any position, thanks to a diaphragm-type carburetor that doubles as a fuel pump.

How does it pick up gas when the tank is steeply tilted? A flexible inlet tube is fastened to a float, tube opening down. No matter where the gas goes, the tube inlet remains submerged.

No matter where man goes to work, the wonderful one-lung engine can lend untiring energy and a companionable purr of willing power.

END

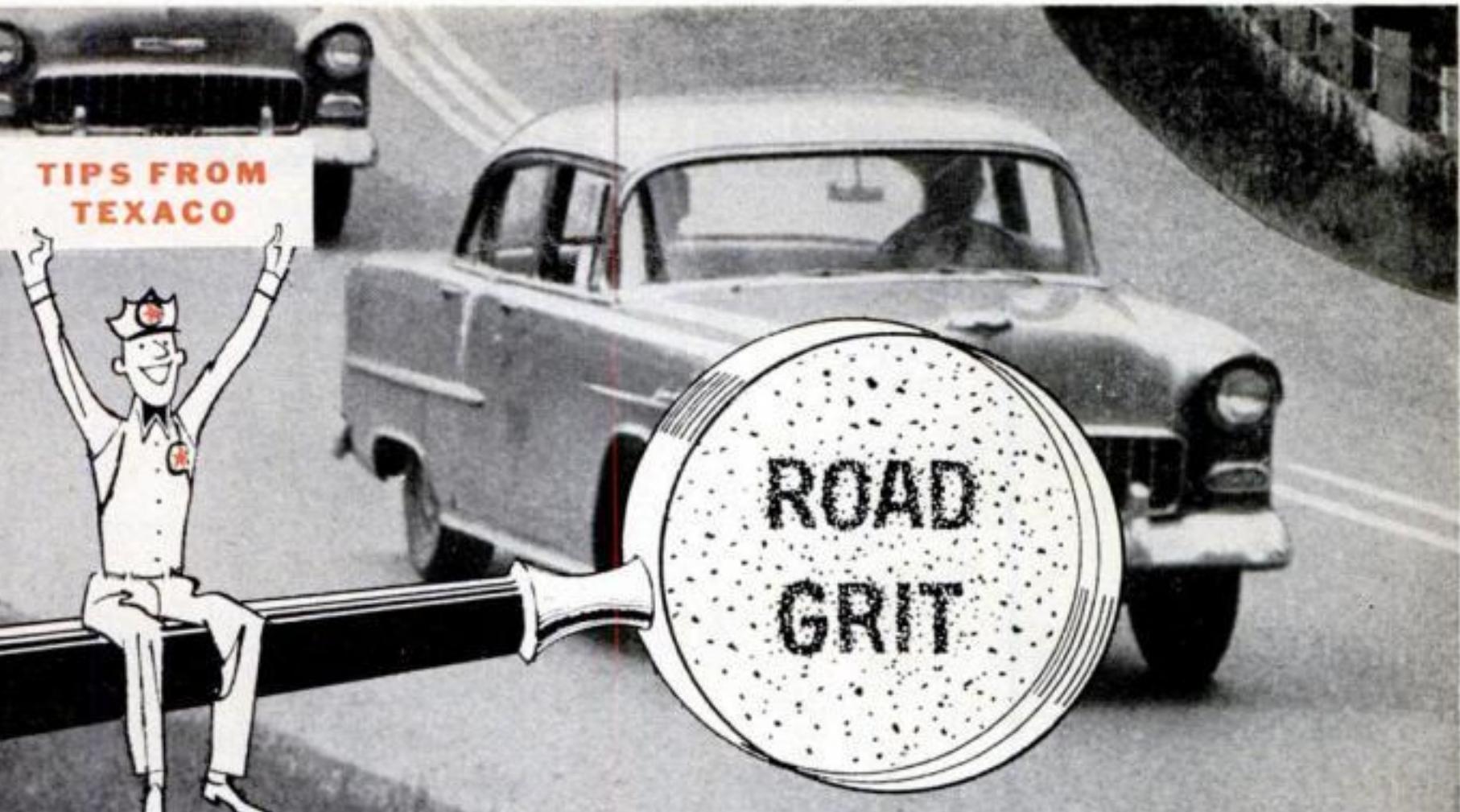
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TIPS FROM  
TEXACO



ROAD  
GRIT

## HOW TO GUARD AGAINST IT...

You may not see it but flying road grit gets sucked into every car engine through the air cleaner and crankcase breather pipes.

Hard enough to scratch glass, its destructive particles circulate in the engine oil and tear away the polished surfaces of bearings, cylinder walls and other machined parts. Oil filters can remove only part of it.

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Havoline Special 10W-30—will protect your engine against rust, varnish, acids and carbon, but no oil ever made can keep road grit from damaging your engine. The one and only *sure* way to get grit and other destructive particles out of your engine is to change oil *regularly*—and a good policy is at least every 1,000 miles. Changing your oil regularly is *mighty cheap insurance!*

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that  
thinks  
for itself



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**TEXACO DEALERS**  
IN ALL 48 STATES

Texaco Products are also distributed in Canada, Latin America, and Africa.



*This story actually happened. The man's name has been changed and this is not his photograph, but the facts are true.*

## "Your name is on the list"



Doug Mott was not surprised. The recession was on and the assembly line where he worked was almost at a standstill.

And then, strangely, the boss began to smile. "You know how the Engineering Department sends us blueprints and then we have to send them back for revision because they just aren't practical to produce?" Doug nodded . . . wondering. "That's waste . . . and we can't allow it to continue. That's why we thought that if we had a man who knew assembly and production — and drafting, too — he could act as liaison man between engineering and production. You know production, Doug . . . and you're studying drafting with I.C.S. You've got a new job. Congratulations!"

Doug Mott now heads a drafting room. But he will never forget the day his name was on the list to be laid off.

Good times or bad, I.C.S. training sets a man off from his fellows, puts him on the road to promotion. You can start on that road by filling out the coupon *now!*

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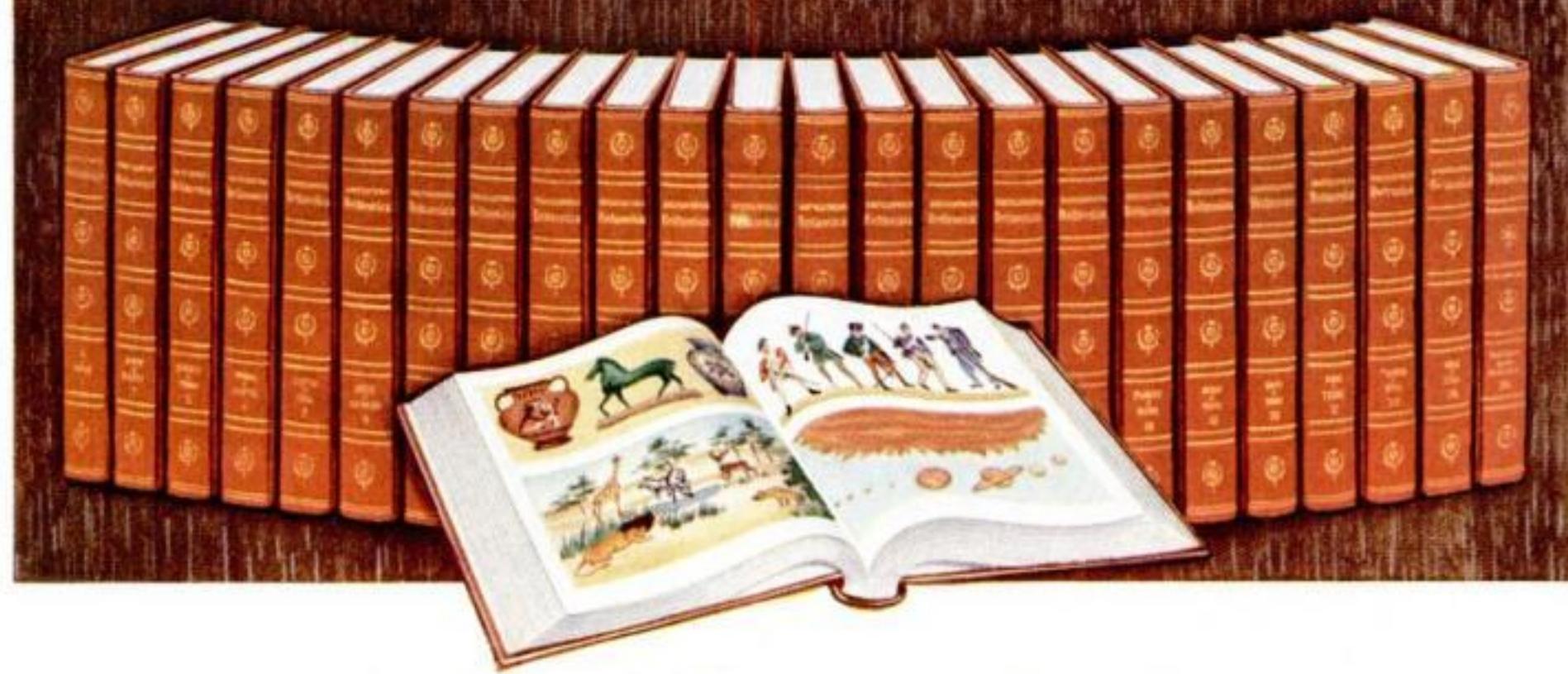
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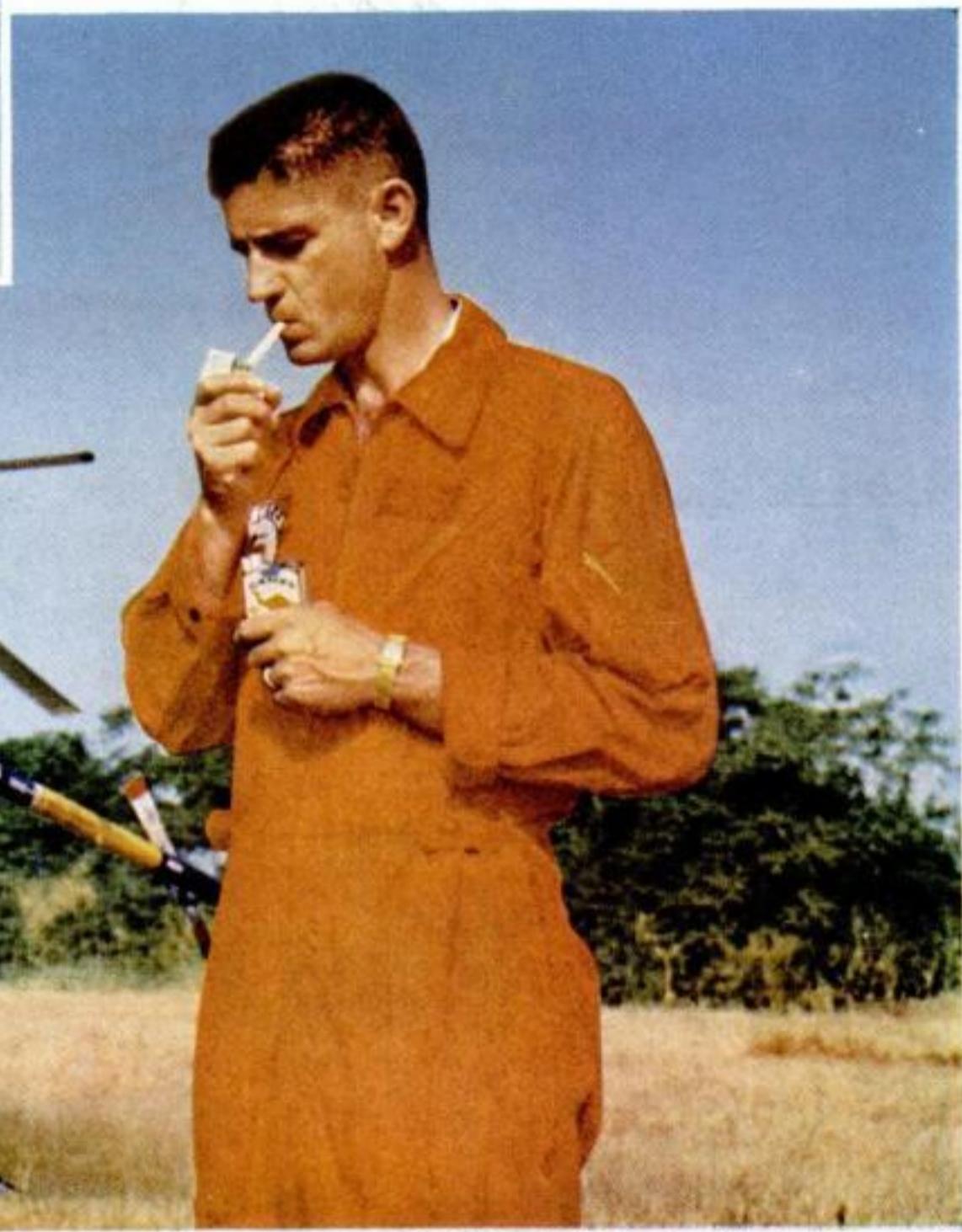
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